MAG 2007 FIVE PERCENT PLAN FOR PM-10 FOR THE MARICOPA COUNTY NONATTAINMENT AREA

APPENDICES

VOLUME TWO

DECEMBER 2007

MARICOPA ASSOCIATION of GOVERNMENTS

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APPENDIX A

Exhibit 1: Letter from Governor Wesley Bolin Designating the Maricopa Association of Governments as the Lead Air Quality Planning Organization for Maricopa County.

Exhibit 2: 1992 Memorandum of Agreement for Air Quality Planning.

Exhibit 3: Letter from Felicia Marcus, EPA Region IX Administrator to Russell Rhoades, Director of the Arizona Department of Environmental Quality Dated September 18, 1996.

Exhibit 4: Modified Second Consent Decree. Ober vs. Environmental Protection Agency. March 25, 1997.

Exhibit 5: Final Rulemaking to Approve in Part and Disapprove in Part the ADEQ Plan for Attainment for the 24-hour PM-10 Standard for the Maricopa County PM-10 Nonattainment Area. Environmental Protection Agency. August 4, 1997.

Exhibit 6: Approval and Promulgation of Implementation Plans; Arizona - Maricopa County PM-10 Nonattainment Area; Serious Area Plan for Attainment of the PM-10 Standards; Final Rule. July 25, 2002.

APPENDIX B

Exhibit 1: 2005 Periodic Emissions Inventory for PM-10 for the Maricopa County, Arizona, Nonattainment Area. May 2007.

Exhibit 2: MAG Analysis of Particulate Control Measure Cost Effectiveness. Sierra Research, Inc. April 18, 2007.

Exhibit 3: Air Quality Technical Advisory Committee Recommendations on the Suggested List of Measures to Reduce PM-10 Particulate Matter. March 28, 2007.

Exhibit 4: State Assurances that the State has the Authority to Implement the Measures in the Plan: A.R.S. Section 49-406 I. and J.

APPENDICES (Continued)

APPENDIX C

Exhibit 1: Technical Document in Support of the MAG 2007 Five Percent Plan for PM-10 for the Maricopa County Nonattainment Area. Maricopa Association of Governments. December 2007.

APPENDIX D

Exhibit 1: Public Hearing Process Documentation

Exhibit 2: Certification of Adoption

APPENDIX B

EXHIBIT 2:

MAG ANALYSIS OF PARTICULATE CONTROL MEASURE COST EFFECTIVENESS. SIERRA RESEARCH, INC. APRIL 18, 2007.

sierra research

Report No. SR2007-04-03

Analysis of Particulate Control Measure Cost Effectiveness

prepared for:

Maricopa Association of Governments

April 18,2007

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April 18, 2007

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Analysis of Particulate Control Measure Cost Effectiveness

Table of Contents

EXECUTIVE SUMMARY

Despite the implementation of some of the most stringent control measures in the country, a portion of Maricopa County continues to violate the national ambient air quality standards (NAAQS) for fine particulate matter (PM_{10}). As the designated air quality regional planning agency for Maricopa County, the Maricopa Association of Governments (MAG) is responsible for preparing State Implementation Plan (SIP) revisions demonstrating attainment of the NAAQS. In July 2002, EPA approved the most recent Maricopa County SIP submission demonstrating attainment of the ambient PM_{10} standard. At that time EPA granted the request for an extension of the date for attaining the PM_{10} standards to December 31, 2006.

Subsequent to that approval, several monitors continued to record exceedances of the 24-hour PM_{10} standard. As a result of exceedances recorded in 2004, 2005 and 2006 at six monitoring sites, the nonattainment area was unable to attain the PM_{10} standards by the December 31, 2006 deadline.

For areas that fail to attain the PM_{10} standard by the applicable attainment date, section 189(d) of the Clean Air Act requires that a Five Percent Plan for PM_{10} be submitted to EPA within one year of the attainment date. MAG must therefore submit a new PM_{10} attainment plan to EPA by December 31, 2007. That plan must show reductions in PM_{10} emissions of five percent per year until attainment is reached at all monitors.

To address this requirement, MAG commissioned a study to prepare descriptions of a preliminary list of PM_{10} control measures for use by MAG's Air Quality Technical Advisory Committee (TAC) in recommending a Suggested List of Measures for the Five Percent Plan for PM_{10}. A total of 46 separate control measures were addressed in the study. For each measure the following information was prepared:

- Narrative description;
- Suggested implementing agency;
- An estimate of the cost of implementation;
- An estimate of the PM_{10} emission reduction potential;
- An estimate of the cost effectiveness ($/ton of PM_{10} reduced); and
- A discussion of implementation issues and comments.

To support the preparation of this information, contacts were established with other serious area PM_{10} nonattainment areas, including Clark County, Nevada, San Joaquin Valley and the South Coast Air Quality Management District to assess their experience with individual control measures. Reviews of relevant dust control literature were also performed to obtain data on measured emission reductions. Contacts were established

with local agencies and businesses to determine the cost of labor, equipment, materials, etc., located in Maricopa County. The recently released 2005 PM_{10} emission inventory* was reviewed to ensure that emission estimates of control measure benefits were computed in a manner that is consistent with methods used to estimate source specific emissions. Detailed spreadsheets were prepared to document the sources of information, assumptions and methods used to prepare estimates of emission benefits, costs and cost effectiveness for each control measure.

Table 1 provides a summary of the cost effectiveness estimates prepared for each of the control measures. The measures are ranked on the basis of their cost effectiveness from the lowest to the highest. One of the measures, #25 Encourage Use of Leaf Vacuums to Replace Blowers was found to have no PM_{10} emissions benefit. Due to uncertainty in available estimates or alternate options for control, a range of cost effectiveness was computed for several control measures. For these measures, the midpoint in the range of cost effectiveness estimates was used to establish their ranking. Insufficient information is available to quantify the costs and benefits of several control measures and they are listed as unknown. Also listed in the table are notes on the degree of confidence in the listed estimate (L for low, M for medium and H for high) and the emission source category that would be impacted by the measure.

A summary of the information prepared for each control measure follows Table 1.

* 2005 Periodic Emissions Inventory for PM_{10} for the Maricopa County, Arizona, Nonattainment Area, Public Review Draft, January 23, 2007.

Table 1
PM_{10} Control Measures Ranked by Increasing Cost Effectiveness

Measure No.	Measure	Cost-Effectiveness ($/ ton of PM_{10})	Degree of Confidence in Ranking	PM_{10} Emissions Category Impacted by the Measure
29	PM-10 Certified Street Sweepers	$4	M	Paved Road Dust
22	Model Cumulative Impacts	$141	M	Industry
33	Pave or Stabilize Existing Dirt Roads & Alleys	$141	M	Unpaved Roads
26	Reduce Off-Road Vehicle Use	$230	H	Off-Road Vehicle Dust
5	Dedicated Coordinator for Unpaved Roads/Vacant Lots	$534	M	Unpaved Rds+Vacant Lots
34	Limit Speeds to 15 mph on Dirt Roads	$899	H	Unpaved Roads
35	Prohibit New Dirt Roads and Lot Splits	$2,646	H	Unpaved Roads
1	Public Education & Outreach	$7,898	M	Construction
40	Enhanced Enforcement of Trespass Ordinances & Codes	$7,961	L	Vacant Lots
3	Core Dust Control Training Program	$9,990	M	Construction
8	Certification Program for Dust-Free Developments	$10,752	M	Construction
15	Conduct Nighttime Inspections	$10,752	M	Construction + Industry
23	Conduct Nighttime and Weekend Inspections	$10,752	M	Construction + Industry
2	Extensive Dust Control Training Program	$12,494	M	Construction
4	Dust Managers at Large Construction Sites	$14,285	M	Construction
28	Require Ultra-Low Sulfur Diesel for Nonroad Equipment	$16,000	H	Nonroad Exhaust
9	Better-Defined Rule 310 Tarping Requirements	$16,085	M	Construction
36	Pave or Stabilize Unpaved Shoulders	$18,452	M	Unpaved Shoulders
32	Pave or Stabilize Existing Unpaved Parking Lots	$21,162	M	Unpaved Parking Lots
11	Self-Monitoring for Sources Over 50 Acres	$21,530	M	Construction + Industry
24	Ban or Discourage Leaf Blowers on HPA Days	$21,851	H	Leaf Blower Dust
39	Restrict Vehicular Use & Parking on Vacant Lots	$30,706	L	Vacant Lots
41	Vacant Lots Stabilized by County if Owners Do Not Respond	$31,367	L	Vacant Lots
38	Increase Enforcement of Rule 310.01 for Vacant Lots	$31,814	L	Vacant Lots
19	Fully Implement Rule 316	$32,276	M	Industry
27	Incentives for Nonroad Diesel Engine Retrofits	$48,000	H	Nonroad Exhaust
12	Mobile Monitoring to Measure PM-10 and Issue NOVs	$54,233	M	Construction + Industry
16	Increase Inspection Frequency for Permitted Facilities	$65,765	M	Industry
17	Increase Inspections in Highest PM-10 Density Areas	$65,899	M	Industry
6	Strengthen Stringency & Enforcement of Trackout Provisions	$67,653	L	Paved Road Dust
30	Retrofit Onroad Diesel Engines	$120,000	H	Onroad Mobile
18	Notify Violators More Rapidly to Promote Immediate Compliance	$122,575	NA	Construction + Industry
46	Restrict Use of Outdoor Fireplaces & Pits	$161,000	H	Woodburning
37	Pave or Stabilize Unpaved Access to Paved Roads	$168,025	M	Paved Road Dust
14	Maintenance Requirements for Paved Roads & Parking Lots	$320,444	H	Industry
20	Use PM-10 Certified Sweepers on Private Paved Areas	$320,444	H	Industry
31	Repave or Overlay Paved Roads with Rubberized Asphalt	$2,460,441	H	Paved Roads - Tire Wear
25	Encourage Use of Leaf Vacuums to Replace Blowers	NA	H	Leaf Blower Dust
7	Increase Fines for Dust Control Violations & Publish Violators List	Unknown	NA	Construction + Industry
10	Conduct Just-In-Time Grading	Unknown	NA	Construction
13	Cease Dust Generation Activities During Stagnation Conditions	Unknown	NA	Construction + Industry
21	Shift Hours of Operation During Stagnant Conditions Nov-Feb	Unknown	NA	Industry
42	Schedule Improvements on Streets to Retain Alternate Routes	Unknown	NA	Onroad Mobile
43	Build Park and Ride Lots Earlier	Unknown	NA	Onroad Mobile
44	Coordinate Public Transit Services with Pinal County	Unknown	NA	Onroad Mobile
45	Increase Fines for Open Burning (Currently $25)	Unknown	NA	Woodburning

1. PUBLIC EDUCATION AND OUTREACH (e.g., CLARK COUNTY) WITH ASSISTANCE FROM LOCAL GOVERNMENTS

In January 2007, the Maricopa County Board of Supervisors launched the Bring Back Blue clean air initiative, which is a comprehensive outreach program designed to educate the public on the health effects and sources of particulate matter emissions and reduce the PM_{10} emissions in Maricopa County. After meeting with stakeholders (including Arizona Department of Environmental Quality [ADEQ], Maricopa Association of Governments [MAG], and health organizations), conducting market research, and receiving public input, an extensive media campaign was developed, which includes television, radio and print ads, billboards, brochures, posters, and a program website (www.bringbackblue.org). The campaign aims to curtail activities that contribute to the PM_{10} inventory in the area by asking the public, among others, to reduce vehicle travel, avoid driving on dirt roads, avoid use of dust blowing and PM_{10}-emitting gardening equipment, reduce outdoor burning activities, and conserve electricity. The 2007 budget for the Bring Back Blue initiative is set at $1.025 million.

Similar programs have been implemented in other areas in the country. In Las Vegas, NV, the O-liminate Ozone program and Dust Campaign involve an annual budget of about $1 million to cover, among others, TV, radio and newspaper ads, billboards, school programs, educational public events throughout the year, and full-time program coordinators. In Sacramento, CA, the Spare the Air program is aimed at educating the public and reducing vehicle travel, along with associated emissions, during days with forecasted high ozone levels. During the 2006 ozone season (six warmer months), the Spare the Air program budget of over $500,000 included the cost for TV and radio airtime for alerts during forecasted high-ozone days, TV and radio commercials, and processing of air quality monitoring and meteorological data to create forecasts for upcoming days.

Suggested Implementing Entity

This program is being coordinated by the Maricopa County Air Quality Department.

Cost

Based on consultation with Clark County, NV, which has a similar public outreach campaign, the Bring Back Blue initiative was approved with a 2007 budget of about

$1.025 million. The budget covers the cost for the media campaign, public outreach, and additional program development (i.e., additional promotional material, further public outreach, and other media expansions).

Emission Reduction

Because the Bring Back Blue campaign is new in Maricopa County, direct estimates of the associated PM_{10} emission benefits are not available. Vehicle trip reduction estimates are available from a similar outreach program in Sacramento, CA, the Spare the Air program, which is designed to control emissions of ozone precursors during days with forecasted high ozone levels.

Averaged over the last seven ozone seasons, public surveys revealed that about 1.8% of drivers purposefully reduced their driving due to the Spare the Air campaign in Sacramento. In addition, each driver reduced his or her driving an average of 2.8 trips per day. Assuming an average trip length of about 10 miles (based on U.S. DOT Travel Trends), the VMT reduction due to the Spare the Air program amounts to about 1.4% of the total VMT in the Sacramento region. Although the Sacramento and Maricopa County programs have similar costs on a per-day basis, the target number of PM_{10} nonattainment area households for the Bring Back Blue campaign is more than 2.5 times higher than the Sacramento region. Therefore, adjusting the reduction by the ratio of the program's cost per target area household, the Maricopa County daily VMT is projected to be reduced by about 0.5% due to the Bring Back Blue program in 2007, which is equivalent to about 0.36 tons of PM_{10} per day from vehicle exhaust and re-entrained dust from paved and unpaved roads. This represents a conservative estimate, as reductions from other PM_{10} sources addressed by the campaign—such as gardening equipment, electricity use, and outdoor burning activities—are not included.

Cost Effectiveness

Using the projected 2007 benefit of 0.36 tons of PM_{10} per day and the daily program cost of $2,808, the estimated cost-effectiveness ratio is $7,898/ton of PM_{10}.

Implementation Issues/Comments

Compliance with this measure is voluntary, so credit taken for this measure could be subject to EPA limitations.*

* EPA memorandum from Richard Wilson (10/24/1997) established credit limits for Voluntary Mobile Source Emission Reduction Programs (VMEPs) of 3% total projected future year emission reductions required to attain the appropriate NAAQS.

2. EXTENSIVE DUST CONTROL TRAINING PROGRAM (e.g., CLARK COUNTY)

The Maricopa County Air Quality Department is currently offering two types of training classes: (1) Dust Control Application, and (2) Rule 310 Dust Training. The first explains how to properly fill out dust control applications and is offered 10 times per year. The second provides guidance to help keep businesses in compliance with the requirements of Rule 310 and is offered 11 times per year. Attendance is voluntary. No direct credit is claimed in the Maricopa County emissions inventory for the conduct of these courses; however, the benefits are theoretically captured in the overall estimate of Rule Effectiveness.

Clark County offers dust control training to local contractors and other major sources of PM_{10} emissions to familiarize them with air quality regulations, the most effective ways to reduce PM_{10} emissions, and air pollution health effects. Upon completing the course and passing an examination, each participant is issued a Certificate of Completion (i.e. a dust card). The courses are offered weekly at Clark County facilities and frequently presented offsite to employees of individual companies. All onsite supervisors and foremen are required to have a dust card. The Certificate is valid for a period of three years, after which a refresher course is required for recertification. The course is not free—the cost of the training is recovered though a nominal fee of $35. Discussions with Clark County's Department of Air Quality and Environmental Management (DAQEM) indicated that over 20,000 people have completed the training course since it was instituted in 1998.

This measure would adopt a more extensive dust training program, like the one currently being offered by Clark County.

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

In evaluating the cost of this measure, we assumed that all construction supervisors and foremen would complete a 4-hour dust control training class. The key change in behavior resulting from the class would be an increase in the frequency of on-site watering. The combined cost of class attendance and increased watering frequency on a 50-acre construction site was estimated to cost $839/day. For a six-month construction project, the total cost would be $111,670.

Emission Reduction

Emission benefits were computed using the WRAP fugitive dust handbook and assuming a baseline 50% control efficiency as reported in the recently completed Rule Effectiveness Study. The analysis assumed that the benefit of this measure would be to operate an additional water truck full-time on site to further control fugitive dust emissions. This assumption produced an increase in control efficiency to 70% and an emission reduction of 8.9 tons of PM_{10} per 50-acre project. This translates into a daily reduction of 135 lbs/day of PM_{10}.

Cost Effectiveness

The overall cost-effectiveness is estimated to be $6.25/lb or $12,494 per ton of PM_{10} reduced. Since a typical residential construction project is estimated to run for six months, the training costs are distributed over six projects over the 3-year life of the training class certificate.

Implementation Issues/Comments

This analysis assumed that Maricopa County would be reimbursed by attendees for the cost of the course. No additional enforcement effort was assumed to ensure that supervisors and foremen comply with the training requirements.

3. CORE DUST CONTROL TRAINING PROGRAM WITH VIDEO PROVIDED TO LOCAL GOVERNMENTS AND PRIVATE SECTOR

The Maricopa County Air Quality Department is currently offering two types of training classes: (1) Dust Control Application, and (2) Rule 310 Dust Training. The first explains how to properly fill out dust control applications and is offered 10 times per year. The second provides guidance to help keep businesses in compliance with the requirements of Rule 310 and is offered 11 times per year. Attendance is voluntary. No direct credit is claimed in the Maricopa County emissions inventory for the conduct of these courses; however, the benefits are theoretically captured in the overall estimate of Rule Effectiveness.

As described in Measure #2, Clark County has implemented a more extensive dust control training program. One element of that program includes distributing video recordings of the course to broaden the number of people exposed to dust control education within the community. Due to the length of the course, which is several hours, the video presents a shortened version and excludes certain segments (including the exam).

This measure would develop a set of training materials, including videos, manuals, forms, tests, etc., that constitute a core training program. These materials could then be used to "train the trainer" so that individual cities and towns could extend the reach of the existing training program.

Suggested Implementing Agency

This measure would be implemented by Maricopa County, cities and towns.

Cost

The cost of producing the "core" training materials is estimated to be $100,000. No additional staff time is assumed to implement the program. The key change in behavior resulting from the training would be an increase in the frequency of on-site watering. The primary cost of increased compliance is assumed to be the operation of an additional watering truck on a half-time basis. The combined cost of the video and increased watering frequency on a 50-acre construction site was estimated to cost $420/day. For a six-month construction project, the total cost would be $55,782.

Emission Reduction

Emission benefits were computed using the WRAP fugitive dust handbook and assuming a baseline 50% control efficiency as reported in the recently completed Rule Effectiveness Study. The analysis assumed that the benefit of this measure would be to operate an additional water truck half time on site to further control fugitive dust emissions. This assumption produced an increase in control efficiency to 62% and an emission reduction of 5.6 tons of PM_{10} per 50-acre project. This translates into a daily reduction of 84 lbs/day of PM_{10}.

Cost Effectiveness

The overall cost effectiveness is estimated to be $4.99/lb or $9,990 per ton of PM_{10} reduced.

Implementation Issues/Comments

The analysis assumes that videos are distributed free of charge and that the cost of production is distributed across 1,600 project per year.*

* 2005 Periodic Emission Inventory for PM_{10}, Public Review Draft, January 23, 2007.

4. DUST MANAGERS REQUIRED AT CONSTRUCTION SITES OF 50 ACRES AND GREATER (e.g., CLARK COUNTY)

Under Rules 310, 310.01 and 316, responsibility for dust control is currently vested in either the project owner and/or operator of a dust generating operation. Their knowledge and efforts to implement controls are reflected in the current assessment of Rule Effectiveness.

Clark County requires projects having 50 or more acres of actively disturbed soil at any time to designate a full-time Dust Control Monitor. This requirement is applicable to multiple sites that are individually permitted at less than 50 acres each, if they are adjacent to one another, under common ownership, or are within a master planned community, and together they have 50 acres or more of disturbed soil. The training requirements to obtain a dust monitor card are significantly greater than those required for a dust card. Training lasts a full day and includes information on soil mechanics, water application, regulations, enforcement, etc. Applicants are required to obtain a Visual Emissions Evaluation (VEE) Certificate, so that they can measure plume opacity at the job site. The course is not free; the cost of the training is recovered through a fee of $500 per person.

This measure would adopt the Clark County requirements for Dust Monitors for projects with 50 acres or more of actively disturbed soil.

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

In evaluating the cost of this measure, we assumed that all Dust Managers would complete a day-long dust control training class and obtain a VEE. The key change in behavior resulting from the class would be an increase in the frequency of on-site watering. The analysis also assumed that the salary commanded by a Dust Manager would be 10% above the salary of a foreman or construction supervisor. The combined cost of employing a Dust Manager on a full-time basis and increasing watering frequency on a 167-acre construction site, of which 50 acres or 30% would be actively disturbed at any one time, was estimated to be $2,865/day. For a six-month construction project, the total cost would be $381,067.

Emission Reduction

Emission benefits were computed using the WRAP fugitive dust handbook and assuming a baseline 50% control efficiency as reported in the recently completed Rule Effectiveness Study. The analysis assumed that the benefit of this measure would be to operate an additional water truck full-time on site to further control fugitive dust emissions. This assumption produced an increase in control efficiency to 70% and an emission reduction of 26.7 tons of PM_{10} per 167-acre project. This translates into a daily reduction of 402 lbs/day of PM_{10}.

Cost Effectiveness

The overall cost effectiveness is estimated to be $7.14/lb or $14,285 per ton of PM_{10} reduced. Since a typical residential construction project is estimated to run for six months, the training costs are distributed over six projects over the three-year life of the training class certificate.

Implementation Issues/Comments

This analysis assumed that Maricopa County would be reimbursed by attendees for the cost of the course. No additional enforcement effort was assumed to ensure that Dust Managers would comply with the training requirements. While this measure is less cost effective than Measures #2 or #3, it is anticipated that compliance under this approach may in fact be higher. The reason is that a single individual with clear authority and responsibility for dust control is likely to be more effective than an approach that distributes responsibility.

5. DEDICATED ENFORCEMENT COORDINATOR FOR UNPAVED ROADS AND VACANT LOTS (e.g., CLARK COUNTY)

Maricopa County does not currently have a position dedicated to inspecting unpaved roads and vacant lots. Instead, responsibility is distributed across a staff of inspectors. Unpaved road enforcement is active, but conducted in response to complaints. Vacant lot enforcement has become proactive with inspections of literally thousands of lots in late 2006. The recently completed Rule Effectiveness Study* determined that vacant lots and open areas have a rule effectiveness of 68%. Maricopa County, however, did not include any benefit from Rule 310.01 in the estimate of 8,490 tons of PM_{10} emitted from vehicles operating on unpaved roads. Unpaved road emissions are a significant source of PM_{10} and are estimated to account for 9.3% of the PM_{10} emitted within the nonattainment area in 2005. While this may be an overestimate of the emissions, the recent analysis of the effectiveness of Rule 310.01 did not address unpaved roads (the focus instead was on vacant lots), so the level of enforcement in 2005 is unclear.

Currently, Rule 310.01 requires emissions from unpaved roads (including alleys) with traffic levels exceeding 150 vehicles per day to be controlled by one of the following methods:

- Pave;
- Apply dust suppressants; or
- Uniformly apply and maintain surface gravel.

The non-paving measures are subject to stabilization and opacity limitations. Vacant lots are subject to trespass and stabilization controls within 60 days following discovery of vehicle use.

Clark County has placed substantial emphasis on controlling emissions from unpaved roads and vacant lots. Discussions with Clark County staff indicated that while no single position is dedicated to tracking activity on unpaved roads and vacant lots, a significant portion of a supervisor's time and that of related inspectors is focused on this activity. Overall, it is estimated that roughly three full-time staff positions are focused solely on unpaved roads and parking lots in Clark County.

Recognizing the significance of fugitive dust emissions from unpaved roads and vacant lots, this measure would establish a dedicated enforcement coordinator with

* Rule Effectiveness Study for Maricopa County Rules 310, 310.01 and 316, Final Draft, Kathleen Sommer, Maricopa County Air Quality Department, January 23, 2007.

responsibility for tracking activity on these facilities and enforcing Rule 310.01 requirements as appropriate.

Suggested Implementing Agency

This measure would be implemented by Maricopa County, cities and towns.

Costs

There are two elements of cost for this measure: enforcement and palliative application. The enforcement cost includes the salary of a full-time coordinator, a dedicated vehicle, and a $10,000/year budget for obtaining traffic counts. According to tests conducted in 1995 by MCDOT, the most cost-effective palliative is Ligno 10, which has an application cost of $769/mile. The combined cost of enforcement and palliative application is estimated to be $3,767 mile per year.

Emission Reduction

The MCDOT study computed a control efficiency of 21.9% compared to uncontrolled conditions when applied once per year. This measure was assumed to be applied to the higher traffic unpaved roads included in the 2005 Periodic Emission Inventory, which were assumed to have traffic levels of 120 vehicles per day. This measure was estimated to reduce fugitive dust emissions by 7.0 tons per mile per year.

Cost Effectiveness

The overall cost effectiveness of this measure is estimated to be $0.27/lb or $534/ton.

Implementation Issues/Comments

The MCDOT data need to be investigated more to ensure that the Ligno 10 can remain effective on higher-volume unpaved roads. Stabilizing roads will make it easier to drive faster and raise speed control and liability issues. Before this measure can be implemented, data on traffic volumes will have to be collected to identify candidate roads for stabilization.

6. STRENGTHEN STRINGENCY AND ENFORCEMENT OF THE TRACKOUT PROVISIONS OF RULE 310 AND RULE 310.01

PM_{10} emissions are produced indirectly by soil tracked out of construction or industrial sites onto paved, publicly maintained roads. Maricopa County estimates that paved roads produced 13,783 tons or 15% of the PM_{10} emitted annually within the nonattainment area in 2005. Research supported by MAG has confirmed that trackout is a significant source of fugitive dust within the Salt River Basin and that its contribution to monitored values could be higher than suggested by the inventory estimates.

Currently, MCAQD Rule 310 requires trackout or spillage that exceeds 50 feet in length on public roads to be removed immediately. For visible trackout that is less than 50 feet in length, Rule 310 requires removal once per day at the end of working hours. To prevent trackout, owners are currently required to implement one of the following control measures:

- Install either a grizzly or wheel wash system at each access point;
- Install a gravel pad at least 30 feet wide, 50 feet long and 6 inches deep; or
- Pave from the point of access for a centerline distance of 100 feet and width of 20 feet.

Recent analysis of Rule 310 indicates that its effectiveness is on the order of 50% and suggests that there is an opportunity for improvement. This measure would reduce the allowable trackout or spillage length by 50% and increase the frequency of inspections at locations with a history of violations.

Suggested Implementing Agency

This measure would be implemented by Maricopa County under Rule 310.

Cost

The principal cost of this measure, which will involve increased access point sweeping, will be borne by industry. A key assumption is that those facilities with high trackout rates will require frequent sweeping (assumed to be once every 2 hours or 5 times per day). To simplify the calculations, it is also assumed that each facility has only one access point. The cost of increased sweeping is estimated to be $2,561 per access point per year. The cost of increased enforcement is estimated to be $3,766 per access point

per year. The total per access point per year is $6,326. The original analysis assumed that $/mile sweeping cost provided by the County would be charged to both transit miles to the job site and miles swept. Further review determined that this approach inflated the overall cost of sweeping since brooming and washing activities of the sweeper would not be in use during transit to the job site. Therefore, the cost of sweeping is now based solely on the miles swept at the job site.

Emission Reduction

The benefit of the increased sweeping frequency was estimated by first computing the amount of material that would be dropped by 40 heavy-duty trucks exiting a facility each day. The baseline estimate assumed the access point is not currently being swept. The control scenario assumes that the access point is swept every two hours during work hours. The benefit computed for this measure is estimated to be 215 lbs of PM_{10} per access point per year. The original analysis assumed that the length of trackout being swept was 25 feet. A review of the trackout analysis contained in the Salt River TSD showed a minimum measured trackout length of 455 feet. The analysis was revised to include this value, which significantly increased the length of road being swept and the pounds of PM_{10} reduced per access point.

Cost Effectiveness

The cost effectiveness of this measure is estimated to be $33.85/lb and $67,653/ton.

Implementation Issues/Comments

The benefits of this measure are dependent on assumptions about the baseline compliance with Rule 310. This analysis assumed full compliance with Rule 310, which significantly deflates the amount of material that is tracked-out and inflates the cost effectiveness of the measure.

7. INCREASE FINES FOR DUST CONTROL VIOLATIONS AND PUBLISH LIST OF VIOLATORS

The primary goal of the Maricopa County Air Quality Department's penalty policy* is to deter future violations by recovering the economic benefit of noncompliance plus an additional deterrence amount that reflects the seriousness of the violation. The amount of a penalty determined under this policy is determined by the following factors:

- A gravity component that is dependent on the severity of a violation;
- The economic benefit of noncompliance;
- The Department's enforcement action costs; and
- Consideration of mitigating factors.

Penalties calculated using this guidance are only used in settlement negotiations. In the event that settlement is not possible and litigation is needed to achieve compliance, ARS 49-513† provides authority for the County Attorney to file an action in Superior Court to recover a civil penalty of "not more than" $10,000 per day per violation.

Discussions with Maricopa County enforcement staff indicated that prior to July 2005, the County Attorney was responsible for settlement negotiations. At that time there was a backlog in uncompleted settlements that stretched back to 2003 and the penalties averaged less than $1,000 per violation. Starting in July 2005, the Enforcement Division assumed responsibility for settlement negotiations. Since that time the backlog in settlements has dropped to a year and the average cost of a penalty has increased significantly. Current levels are approaching $10,000 for repeat violators and a statute increase will be required to achieve the increase in fines targeted by this measure.

A monthly summary of all settlement cases and penalties assessed is currently provided on the County's website.‡ Each monthly summary includes a description of high profile settlements and a listing of each settlement including the business name, address, location and date of the violation, due date, settlement date and amount of the settlement. This practice appears to satisfy the requirement proposed in this measure to publish a list of violators.

Industry response to the increase in average penalties assessed has assumed several forms:

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* *http://www.maricopa.gov/aq/divisions/enforcement/Default.aspx*

† *http://www.azleg.state.az.us/FormatDocument.asp?inDoc=/ars/49/00513.htm&Title=49&DocType=ARS*

‡ *http://www.maricopa.gov/aq/news.aspx*

- Settlement negotiations are taking longer (the number of meetings required to reach closure has increased);
- Lawyers are frequently representing alleged violators; and
- Industry has started to hire County inspection/enforcement staff to improve their ability to comply with the dust control rule requirements.

The recently completed rule effectiveness study* calculated the following rates for each of the dust control rules:

- Rule 310 – 49% (based on an evaluation of earthmoving sources);
- Rule 310.01 – 68% (based on an evaluation of vacant lots and open areas); and
- Rule 316 – 54% (using an EPA default value because of an insufficient sample of inspected facilities).

These values were calculated using data collected in calendar year 2006, barely one year after the Enforcement Division assumed responsibility for settlement negotiations. Given that behavior change is a lagged response and it has taken time to ratchet up the average amount of penalties assessed, it is expected that the current rule effectiveness rates are higher than calculated in the recent study. A search for an elasticity measuring industry response to an increase in assessed penalties found that none exist.† Lacking this information it is not possible to estimate current rule effectiveness levels.

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

No estimate of the cost of implementing and complying with this measure is available.

Emission Reduction

No estimate of the emissions benefits of this measure is available.

Cost Effectiveness

No estimate of the cost effectiveness of this measure is available.

* Rule Effectiveness Study for Maricopa County Rules 310, 310.01 and 316, Final Draft, prepared by Maricopa County Air Quality Department, January 23, 2007.
† Discussions with EPA and CARB staff confirmed that this information is not available.

Implementation Issues/Comments

Given that the average value of assessed penalties has increased and the maximum penalties assessed for repeat offenders is approaching the ARS defined limit of $10,000 per violation per day, the governing statue, ARS 49-513 would need to be revised in order to implement the increased fines envisioned in this measure. An alternate, possibly more effective method of meeting the goals of this measure could be realized through increasing the number of inspections/year of permitted facilities and job sites. This is because the annual cost of noncompliance will increase more through an increase in the number of inspections and related settlements than it will through an increase in maximum value of the penalty levied per violation.

Discussions with Clark County staff found that increased penalties produce higher compliance rates. They too have a $10,000 per violation per day statutory limit, but have increased penalties by noting separate violations and imposing fines for every day on which a violation occurs. In some cases, penalties have been in the range of $200,000 - $300,000 per NOV. Companies/individuals receiving large penalties have been more cooperative in meeting with the County to work on long-term company-wide Dust Compliance Plans in exchange for lower fines.

8. ESTABLISH A CERTIFICATION PROGRAM FOR DUST FREE DEVELOPMENTS TO SERVE AS AN INDUSTRY STANDARD

A check of the serious PM_{10} nonattainment areas, Clark County, San Joaquin Valley and South Coast and a broader web search confirmed that this measure has not been implemented anywhere else. It represents a fundamentally different approach to reducing fugitive dust, not through regulation, but through the development of incentives (i.e., this measure offers a carrot for improved compliance not a stick). The proposed incentive would be the establishment of a certification program and related public relations campaign that provides publicity value (i.e., bragging rights) for those developments that are certified to be dust free.

Many steps would be required to implement this measure. First, criteria would need to be established that define acceptable emission levels for a dust free development. These levels would need to be negotiated with the industry. Criteria to be considered would include: dust control practices, opacity limits, equipment specifications (e.g., limits on the age and emission rate of construction equipment, fuel specifications, etc.), rule effectiveness, etc. A process for certification would need to be established and might include requirements addressing documentation, measurement/monitoring and inspection. A public awareness program would need to be created to inform the public of the benefits of developments certified as meeting these criteria.

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

No estimate of the cost of implementing and complying with this measure is available. However, cost elements would include:

- Establishing a program;
- Program operation;
- Public Awareness; and
- Industry implementation of incremental control measures needed to be certified as dust free.

Emission Reduction

No estimate of the emissions benefits for this measure is available. The magnitude of the reduction will depend on the benefits of the incremental control measures that are implemented and the level of industry participation. An estimate of the potential benefits can be derived from applying the difference between the current rule effectiveness level for Rule 310 (which is 49%) and the EPA target of 80% rule effectiveness to the 2005 estimate of construction industry PM_{10} emissions in the nonattainment area (i.e., 31% of 37,572 tons/year times an assumed control efficiency rate of 90%). The maximum potential benefit of this measure would be an unknown portion of 10,483 tons/year or 11% of the PM_{10} emission inventory. The point of this discussion is that based on the 2005 emission inventory, measures directed at the construction industry offer significant potential for PM_{10} emission reductions.

Cost Effectiveness

While no specific estimate of the cost effectiveness of this measure is available, an approximate estimate was prepared by quantifying the incremental amount of watering that would be required to achieve the difference between a 49% and 80% reduction in fugitive dust from a representative development (i.e., 50 acre site). Using this approach, the cost effectiveness of this measure was estimated to be $10,752/ton of PM_{10} reduced. This estimate, however, does not include the administrative expenses of designing and implementing the program. These costs would increase the $/ton estimate for this measure.

Implementation Issues/Comments

Discussions should be held with industry to gauge their interest in participating in a dust free certification program before undertaking the effort required to implement this measure.

9. REVISE RULE 310 TARPING REQUIREMENTS TO INCLUDE EMPTY BACKHAUL

Materials such as sand, dirt, gravel, rock, etc. transported in uncovered trucks can be spilled onto public roadways. This material can then be pulverized by traffic, become airborne, and contribute to the paved road fugitive dust emissions (currently estimated to be 13,783 tons per year or 15% of the nonattainment area inventory in 2005).

Emissions from uncovered trucks are currently regulated under Rule 310. Section 308 requires owners and/or operators of haul trucks to meet minimum freeboard requirements, prevent spillage or loss of bulk material, cover all haul trucks with a tarp or suitable enclosure, and clean or cover the interior of a cargo compartment before any empty truck leaves the site when traveling onto paved areas accessible to the public.

This measure is designed to eliminate emissions produced during empty backhauls after a truck has dumped its load of material. Current cleaning and/or tarping practices have been found to be ineffective. This measure would require empty trucks to fully enclose the cargo compartment prior to traveling onto public roadways.

Suggested Implementing Entity

This measure would be implemented by Maricopa County.

Cost

The only cost addressed in this analysis is the labor required to thoroughly cover the empty truck bed and the extra time added to complete daily activity. No increase in enforcement effort was assumed. Vehicles were assumed to make 13 round trips per day and incur an additional cost of $13.42 for compliance per day.

Emission Reduction

The combined emission reduction from 13 trips is estimated to be 1.67 lbs of PM_{10} per truck day.

Cost Effectiveness

The cost effectiveness is estimated to be $8.04/lb or $16,085/ton of PM_{10}.

Implementation Issues/Comments

The analysis assumes that inspectors would be issuing NOVs as part of their daily rounds and that no additional effort would be required to enforce this measure.

10. CONDUCT JUST-IN-TIME GRADING

Disturbed soil is vulnerable to erosion by both wind and water. Sediment controls to limit water pollution impacts from disturbed soil are well established. Stabilization requirements to minimize wind erosion have been implemented by communities that exceed ambient PM_{10} standards under high wind conditions. Examples of those communities include Clark County, Nevada, Coachella Valley, California, Maricopa County, and Bullhead City Arizona. Bullhead City is the only community that has implemented a just-in-time grading control measure.* A description of the ordinance implementing this measure is contained in the community's Maintenance Plan.† It requires "control of dust during grading and excavation," it also requires "that the property be left in a condition that prevents dust from arising." A review of Maricopa County's Rule 310, however, shows that it requires all disturbed surface areas to be stabilized under the following conditions:

- Pre-activity work practices;
- Work practices during operations;
- Temporary stabilization (up to 8 months) required during weekends, after work hours and on holidays; and
- Permanent stabilization required within 8 months of ceasing dust-generating operations.

Since these requirements do not specify any time period when stabilization requirements are in force, it does not appear that a just-in-time grading requirement will provide any additional emission reductions that would not come from the enforcement of Rule 310.

Suggested Implementing Agency

This measure would be implemented by Maricopa County, cities and towns.

Cost

No estimate of the cost of implementing and complying with this measure is available.

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* Discussions with Clark County staff confirmed that they do not have a "just-in-time-grading" control measure. Instead, they recommend that projects be staged so no more than 100 acres are disturbed at a time and the rest of the project is treated with dust suppressants.

† *http://www.azdeq.gov/environ/air/plan/download/bcpm10.pdf*

Emission Reduction

This measure does not appear to offer an emissions benefit.

Cost Effectiveness

No estimate of the cost effectiveness is available.

Implementation Issues/Comments

Discussions with the County confirmed that there is no apparent benefit for this measure.

11. ESTABLISH CONTINUOUS MONITORING REQUIREMENTS FOR PERMITTED SOURCES LARGER THAN 50 ACRES

The continuous monitoring of fenceline PM_{10} concentrations has been imposed on larger surface mining operations in several Western states over the past decade. The intent of this enforcement measure is to provide assurance that ambient air quality standards are not being violated in sensitive areas near these types of projects. Because of the persistence of PM_{10} violations in the Salt River area, the Maricopa County Air Quality Department has asked that a similar approach be evaluated for use at larger construction and mineral production facilities in this area. Under this concept, a facility would be required to operate two or more continuous PM_{10} monitoring instruments and take corrective dust control action whenever the monitors reported exceedances of a specified dust concentration threshold. For the purpose of this analysis, we assumed that the corrective dust control action would consist of increased watering of haul roads and other actively disturbed soil surfaces.

To implement this measure local regulations or permits for earth moving and mineral productions facilities would nee to be modified to include continuous monitoring requirements.

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

The costs of monitoring and watering were derived from cost data reported from earlier studies and local sources. For the cost of monitoring, we assumed that a regulated facility of more than 50 acres would be required to install four optical particle counters along fencelines in each of the cardinal directions from the center of dust-generating activities. As has been required of some energy facility construction sites adjacent to residential areas in California, we assumed that the monitors would run unattended on battery power during business hours and that acquired data would be downloaded and evaluated at the end of each day by a technical consultant. If the data demonstrated an exceedance of an adopted dust threshold, additional watering of nearby dust sources, under direction of the technical consultant, would be performed the next day and each subsequent day as necessary to maintain compliance at the monitor. We assumed that one additional water truck per facility would be pressed into service, and that this truck would be rented from an equipment supply service. The contract cost of the monitoring

and dust control consultant was estimated to be $54,700 per year, and the additional watering cost was estimated to be $111,500 using a leased water truck.

Emission Reduction

Emission reductions were calculated as the difference between baseline and controlled emission scenarios for onsite haul roads. The baseline scenario assumed 45% control of dust emissions (49% rule effectiveness x 90% control efficiency) from onsite construction activities, based on the rule effectiveness study completed by MCAQD in 2007. Uncontrolled construction emissions were estimated to be 46.0 tons of PM_{10}, based on the emission factors published in the WRAP fugitive dust handbook, and baseline emissions incorporating existing controls were estimated to be 20.1 tons for a 50-acre construction project.

The use of an additional water truck was estimated to increase emission control effectiveness to 72.3%, based on data reported by a Midwest Research Institute study of construction dust emissions for the South Coast AQMD in 2001. The increase in control efficiency produced an emission reduction of 7.7 tons of PM_{10} during the duration of a 6-month, 50-acre residential construction project. This is equivalent to a daily emission reduction of 116 lbs per day of PM_{10} during each construction day.

Cost Effectiveness

The overall cost effectiveness for this measure is estimated to be $10.76 per lb or $21,530 per ton of PM_{10} reduced. Sierra performed a similar analysis of this measure for San Joaquin Valley.* The results of that analysis showed a cost effectiveness ranging between $231,000 and $339,000 per ton of PM_{10} reduced. While the cost assumptions used in that study and this study are quite similar, the assumptions about emission benefits are significantly different. The San Joaquin Valley study assumed that monitoring would only indicate a need for watering on 5% of construction days. As a result, the high cost of continuous monitoring produced a small emissions benefit and a high $/ton cost effectiveness estimate. In this analysis it was assumed that watering would occur every day of construction to avoid the cost of an NOV. Thus, essentially the same cost of monitoring would produce a large emissions benefit and a cost effectiveness that is an order of magnitude lower than reported in the San Joaquin Valley study. The actual cost effectiveness would depend on the behavior of the contractor operating the construction site.

* Final BACM Technological and Economic Feasibility Analysis, prepared for the San Joaquin Valley Unified Air Pollution Control District, March 21, 2003.

Implementation Issues/Comments

This analysis assumed the use of contract monitoring and dust control services. The cost effectiveness of this measure will be less if monitoring equipment and additional water trucks are owned by the construction contractor.

12. CONDUCT MOBILE MONITORING TO MEASURE PM_{10} AND ISSUE NOVs

The Maricopa County Board of Supervisors recently approved funding for a state-of-the-art mobile air-monitoring program. The County is currently taking bids on the instruments that will be used to equip a vehicle to measure pollutants on a mobile basis. The vehicle will be able to perform measurements on a variety of regulated pollutants, including ozone, carbon monoxide (CO), $PM_{2.5}$, PM_{10}, NOx and a range of hazardous air pollutants (HAPs). The bids are still open on a number of pieces of equipment; therefore the County does not expect it to become operational for another 18-24 months (i.e., circa 2009). When the vehicle does become operational, it will not be dedicated to PM measurements as it will be used to investigate a broad range of complaints.

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

The cost of a mobile monitoring van is assumed to be equal to the funds approved by the Board of Supervisors (i.e., $500,000). Assuming a useful life of 8 years, the annualized cost of the van will be $93,722 per year. Assuming that the vehicle is dedicated to fugitive dust enforcement, which it is not, the van could be used to monitor 6 properties per day and support the issuance of 2 NOVs per day. Based on these assumptions and the labor required to operate the van and supervise its operation the average cost per property per day is estimated to be $102. This value increases to $107 per property per day when the annualized daily cost of gravel pad is included.

Emission Reduction

Emission benefits were computed based on the assumption that facilities receiving NOVs undertake either trackout control or sweeping. Trackout control was assumed to come from the construction and maintenance of a 50' gravel pad. Based on an EPA analysis* the control efficiency of a 50' gravel bed is 46%. When this value was combined with soil deposition rates, initial silt loadings, size of the trackout area and average Salt River

* Particulate Emission Measurements from Controlled Construction Activities, EPA/600R-01/031, U.S. EPA, April 2001.

traffic volumes, this measure was estimated to reduce 3.9 lbs of PM_{10} per property per day.

Cost Effectiveness

The cost effectiveness of this measure is estimated to be $54,233 per ton of PM_{10} reduced.

Implementation Issues/Comments

The cost and cost effectiveness of this measure could be substantially improved by creating a vehicle that is dedicated to fugitive dust control. Such a vehicle would require much less instrumentation to monitor $PM_{2.5}/PM_{10}$ concentrations as opposed to NOx, HAPs, etc. With a lower initial cost and the same level of PM_{10} reductions the cost effectiveness of the measure would be improved.

13. CEASE DUST GENERATION ACTIVITIES DURING STAGNANT CONDITIONS

An analysis of meteorological data collected for days when the ambient PM_{10} standard has been exceeded in recent years in the Salt River shows:

- Wind speeds are less than 1 meter/second;
- Dispersion is limited because of low mixing heights (i.e., inversions);
- There is limited transport of emissions from outside of the area; and
- Stagnant conditions persist for multi-day periods.

An analysis of the monitoring data shows that maximum concentrations are typically recorded in the early morning hours. This is because the combination of low wind speeds and mixing heights allow concentrations to build over time. High levels of activity in the early morning hours add emissions on top of elevated concentrations from the previous day and lead to exceedances. Concentrations typically drop after about 8 am once there has been enough solar heating to lift the mixing height and increase dispersion.

The goal of this measure is to reduce early morning emissions from facilities located within high emission density areas on days when exceedances are expected to occur. A review of meteorological data collected by ADEQ between November 1st and February 15th for the past 3 years in the Salt River shows that on average the following days were called during that season:

- 8.25 high pollution advisory (HPA) days;
- 8.80 stagnation days occurred; and
- 9.90 exceedances occurred.

This information suggests that participating facilities would need to be able to cease early morning operations on roughly 10 days per season (if High Pollution Watch days are included the number of days would increase to 13). Effort will be required to determine which industries have the flexibility to cease operations during this time period. A variety of implementation issues would need to be investigated and defined to implement this measure, including minimum lead time notification requirements, emission density limits that would define the area of participation, compliance options, the need for tax credits to offset lost production, etc.

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

No estimates of the cost of developing, implementing or complying with this measure are currently available.

Emission Reduction

The emission reductions from this measure would be limited. The number of days in which activities cease would be limited, the number of participating facilities would also be limited as would the geographic coverage. As a result, the emission reductions that would accrue to the Five Percent Plan would be quite limited. However, the successful implementation of this measure would significantly enhance the probability of attainment at monitors located in areas with a history of exceedances.

Cost Effectiveness

Insufficient information is available to estimate the cost effectiveness of this measure.

Implementation Issues/Comments

Another option for implementing this measure is to shift the lost hours of operation to another time period. The cost and benefits of this approach are investigated in Measure #21.

14. ESTABLISH MAINTENANCE REQUIREMENTS FOR PAVED ROADS AND PARKING LOTS

During the field study of Salt River fugitive PM_{10} sources conducted in November and December of 2006, visible emissions were observed from vehicle travel over paved parking lots lightly covered with deposited soil. As a result of this observation, a request was made to evaluate the cost effectiveness of maintaining such paved parking lots and roadways by periodic sweeping with PM_{10}-efficient sweepers.

Under this measure, all paved parking lots and roads would be swept at least every two weeks.

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

The periodic cost of sweeping was estimated from contract data received from the Maricopa County Department of Transportation. A 1-acre paved parking lot was selected for analysis as a typical example. The cost of bi-weekly sweeping of a 1-acre parking lot by a contract service was estimated to be $871 per year.

Emission Reduction

The emission reductions achieved by periodic sweeping were calculated as the difference in paved road travel emissions for surfaces with two different silt loadings. The activity level for unpaved parking published in the 2005 Maricopa County emission inventory of 100 vehicles per day per acre was used as a default activity level for this analysis. The average travel distance per parking cycle on a 1-acre lot was estimated to be the distance from one corner of a square lot to the center of the lot and back along travel links parallel to the sides of the lot (200 feet). The silt level of an unmaintained parking lot (0.60 g/m^2) was assumed to be twice that of the average Salt River street silt level measured and reported in the Salt River technical support document prepared by ADEQ in 2005. Sweeping by a PM_{10}-efficient sweeper was assumed to remove 86%, as measured in tests conducted by the University of California Riverside on sweepers seeking PM_{10}-efficient certification. We also assumed that a completely cleaned parking lot (i.e., with 100% removal of surface silt) returned to pre-swept silt conditions in 10 days of use, from an engineering estimate published in a South Coast Air Quality Management District cost-

effectiveness analysis. On the basis of these assumptions, the emission reduction produced by sweeping a 1-acre parking lot every two weeks was calculated to be 5.4 pounds of PM_{10} per year.

Cost Effectiveness

The overall cost effectiveness is estimated to be $160.22 per pound, or $320,444 per ton, of PM_{10} reduced.

Implementation Issues/Comments

This analysis assumes a relatively low silt loading and low traffic levels of light-duty vehicles operating on parking lots targeted for sweeping. Both of these values are based on engineering estimates. The use of higher values and heavier vehicles, if justified, would improve the calculated cost effectiveness of this measure.

15. CONDUCT NIGHTTIME INSPECTIONS

Currently, inspectors employed by the Maricopa County Air Quality Department (MCAQD) conduct inspections of permitted facilities – construction sites and mineral processing facilities – during normal work hours. Through interviews of mineral facility production staff, we learned that substantial mineral processing and construction activity occurs before daylight during the summer months to take advantage of cooler temperatures, especially for concrete pouring. Nighttime operations also occur to a lesser extent during winter months.

Under this measure, dust control inspections would be conducted during nighttime hours to assure compliance with Rule 310 during these periods. Because the 20% opacity limit in Rule 310 is very difficult to verify and enforce during nighttime hours, we assumed that inspections during these hours would involve use of portable dust monitors and the establishment of new fenceline PM_{10} concentration limits. We assumed that MCAQD would purchase DustTrak optical particle counters and pay inspectors a nighttime pay differential for working these hours. We also assumed that facility operators would increase the use of watering for additional dust control during nighttime hours if inspections found conditions of noncompliance.

The emission scenario we used in this analysis was a 50-acre residential construction site and that increased watering would involve the use of two additional water trucks during nighttime hours.

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

The costs of this measure include enforcement and dust control elements. We assumed that verification of compliance at night would be determined through spot monitoring with a portable optical particle counter. Amortized over an 8-year life, the monitor would cost $3.94 per 50-acre project, assuming that 200 projects were checked each year. Assuming that each project is inspected four times for two hours each by a MCAQD inspector paid a night differential rate, the additional night inspection costs were calculated to be $198.68 per project. We also estimated that processing one notice of violation per project would cost an additional $276.99 per project, for a total of inspection and enforcement costs of $479.31 per project. The use of two additional water trucks during night work hours was estimated to cost $54,433 per project. (A 50-acre residential project is assumed to require 6 months to construct, from data contained in the

WRAP Fugitive Dust Handbook.) The total cost of this measure was calculated to be $54,912 per project.

Emission Reduction

For baseline emissions, we assumed that disturbed areas were being watered every four hours, resulting in a control efficiency of 50%, which is close to the current effectiveness of Rule 310 as reported by MCAQD in 2007. The response to this measure was assumed to be the operation of two additional water trucks during nighttime hours. Disturbed areas would be watered every 1.7 hours, resulting in a control efficiency of 79%. By applying these control efficiencies to the uncontrolled nighttime emissions of 17.9 tons per PM_{10}, we computed the emission reduction to be 3.8 tons of PM_{10} per 50-acre project.

Cost Effectiveness

The cost effectiveness of this measure was calculated to be $5.38 per pound, or $10,752 per ton, of PM_{10} reduced.

Implementation Issues/Concerns

This analysis assumes that additional dust control at an affected project will be gained through additional watering of actively disturbed areas. If other control techniques are used to reduce PM_{10} emissions, both the magnitudes of emission reduction and cost could change dramatically from the scenario considered in this analysis.

In response to comments, the analysis of this measure was modified to account for the benefit that would result from a higher baseline compliance rate (due to a lagged response to recent increases in settlement fines). To account for this response, the baseline control efficiency was increased from 50% to 70%. One additional watering truck would be required to increase control efficiency from a baseline of 70% to the target of 80%. The cost effectiveness computed for this increment is estimated to be $10.82 per lb or $21,631 per ton of PM_{10} reduced.

16. INCREASE INSPECTION FREQUENCY FOR PERMITTED FACILITIES

Maricopa County Air Quality Department (MCAQD) currently conducts formal compliance inspections of the 26 major mineral processing facilities in the Salt River area a total of four times each year.* These inspections are comprehensive in that both physical inspections of operating equipment and document reviews of required records are conducted. Additional inspections of specific equipment, activities, or portions of facilities are conducted on an as-needed basis in responding to complaints.

Under this measure, formal compliance inspections of major facilities would be conducted more frequently. For the purposes of analysis, we assumed that two additional inspectors would be hired by MCAQD and assigned solely to inspections of permitted facilities. Although inspections of permitted facilities would include both stationary sources and construction sites, our analysis looked exclusively at stationary sources. We also assumed that inspections of mineral processing facilities would focus more on evaluations of compliance with operating and emission limitations, and less on recordkeeping requirements, to the extent that each inspector would inspect two permitted facilities per day. We assumed that the predominant violations would be of visible dust limitations on fugitive sources, and that the control option implemented by affected operators would be increases in watering frequencies on haul roads, unpaved traffic areas, and open material transfer operations.

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

The costs of implementing this measure would include additional inspection and enforcement costs borne by MCAQD, and additional dust control costs borne by facilities found to be out of compliance. The salaries of inspection and enforcement staff were obtained from MCAQD, and the costs of additional watering at affected facilities were based on truck rental prices obtained from a local equipment-leasing firm. Labor rates for water truck operation were obtained from the U.S. Bureau of Labor Statistics for the Maricopa area. The costs of increased inspection and enforcement were estimated to be $5,900 per facility per year, and additional watering costs were estimated to be $139,300, for a total of $145,200 per year per facility.

* The Salt River SIP committed to one planned and three surprise inspections of these facilities each year.

Emission Reductions

We computed emission reductions as the difference in emissions for onsite material transport over unpaved haul roads when roads were watered every four hours versus every two hours. From the 2002 emission inventory published in the Salt River PM_{10} Technical Support Document compiled by ADEQ, we reviewed the annual mineral production rates of the larger facilities operating in the Salt River area and selected 500,000 tons per year as a benchmark for analysis. We computed an uncontrolled haul road emission factor for an on-highway haul truck, and applied a calculated control efficiency resulting from road watering every four hours in 2002 to derive a 2002 emission factor for onsite hauling of 1.13 lb/VMT. By dividing total annual haul road emissions reported in the TSD by this emission factor, we estimated that total haul road VMT was 177,940 miles in 2002 for Salt River facilities. By dividing this VMT by the total production rate reported by these facilities of 5,684,987 tons, we computed the onsite average haul distance of mineral product to be 0.031 VMT per ton. We computed onsite haul road emissions for the benchmark facility by multiplying this value by 500,000 tons per year to derive an annual emission estimate of 17,670 pounds of PM_{10} in 2002. Because control regulations have become more restrictive since 2002, for a 2006 emission baseline we assumed that haul roads are being watered every two hours. By estimating a control efficiency for haul road watering every two hours, we computed annual baseline haul road emissions to be 8,835 pounds of PM_{10}.

Under this measure, we assumed that haul road watering frequency would be increased to once per hour. Using the same methodologies, we estimated a control efficiency for this level of watering and applied it to the uncontrolled emission rate to compute controlled annual emissions to be 4,417 pounds of PM_{10} per year. The resulting emission reduction in for this benchmark facility is 4,417 pounds of PM_{10} per year.

Cost Effectiveness

The overall cost effectiveness is estimated to be $32.88 per pound, or $65,765 per ton, of PM_{10} reduced.

Implementation Issues/Concerns

This analysis assumes that additional dust control at an affected facility will be gained through additional watering of haul roads and other actively disturbed areas. If other control techniques are used to reduce PM_{10} emissions, both the magnitudes of emission reduction and cost could change dramatically from the scenario considered in this analysis.

17. INCREASE NUMBER OF PROACTIVE INSPECTIONS IN AREAS OF HIGHEST PM_{10} EMISSIONS DENSITIES

The Arizona Department of Environmental Quality (ADEQ) developed an emission inventory of Salt River sources for use in modeling impacts as part of the Salt River study in 2004-2005. The allocation of emissions to modeling grid cells indicated that the cells having highest PM_{10} emissions densities were those containing the mineral processing operations of the larger production facilities. An increase in the number of proactive inspections of these facilities will result in costs and emission reductions very similar to those analyzed in Measure #16 (Increase Inspection Frequency for Permitted Facilities). One additional cost component under this measure would be the expense of training facility operations foremen in dust control practices through a course developed by the Maricopa County Air Quality Department (MCAQD).

For the purposes of analysis, we assumed that two additional inspectors would be hired by MCAQD and assigned solely to inspections of mineral production facilities in the Salt River area. We also assumed that inspections of mineral processing facilities would focus more on evaluations of compliance with operating and emission limitations, and less on recordkeeping requirements, to the extent that each inspector would inspect two permitted facilities per day. We assumed that the predominant violations would be of visible dust limitations on fugitive sources, and that the control option implemented by affected operators would be increases in watering frequencies on haul roads, unpaved traffic areas, and open material transfer operations.

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

The costs of implementing this measure would include additional inspection and enforcement costs borne by MCAQD, training costs borne by permitted facilities, and additional dust control costs borne by facilities found to be out of compliance. The salaries of inspection and enforcement staff were obtained from MCAQD, and the costs of additional watering at affected facilities were based on truck rental prices obtained from a local equipment-leasing firm. Labor rates for operations foremen attending dust control classes and operators driving water trucks were obtained from the U.S. Bureau of Labor Statistics for the Maricopa area. The costs of increased inspection and enforcement were estimated to be $5,900 per facility per year, training costs were estimated to be $300 per year (assuming training is repeated every three years), and

additional watering costs were estimated to be $139,353, for a total of $145,553 per year per facility.

Emission Reductions

We computed emission reductions as the difference in emissions for onsite material transport over unpaved haul roads when roads were watered every four hours versus every two hours. From the 2002 emission inventory published in the Salt River PM_{10} Technical Support Document compiled by ADEQ, we reviewed the annual mineral production rates of the larger facilities operating in the Salt River area and selected 500,000 tons per year as a benchmark for analysis. We computed an uncontrolled haul road emission factor for an on-highway haul truck, and applied a calculated control efficiency resulting from road watering every four hours in 2002 to derive a 2002 emission factor for onsite hauling of 1.13 lb/VMT. By dividing the total annual haul road emissions reported in the TSD by this emission factor, we estimated that total haul road VMT was 177,940 miles in 2002 for Salt River facilities. By dividing this VMT by the total production rate reported by these facilities of 5,684,987 tons, we computed the onsite average haul distance of mineral product to be 0.031 VMT per ton. We computed onsite haul road emissions for the benchmark facility by multiplying this value by 500,000 tons per year to derive an annual emission estimate of 17,670 pounds of PM_{10} in 2002. Because control regulations have become more restrictive since 2002, for a 2006 emission baseline we assumed that haul roads are being watered every two hours. By estimating a control efficiency for haul road watering every two hours, we computed annual baseline haul road emissions to be 8,835 pounds of PM_{10}.

Under this measure, we assumed that haul road watering frequency would be increased to once per hour. Using the same methodologies, we estimated a control efficiency for this level of watering and applied it to the uncontrolled emission rate to compute controlled annual emissions to be 4,417 pounds of PM_{10} per year. The resulting emission reduction for this benchmark facility is 4,417 pounds of PM_{10} per year.

Cost Effectiveness

The overall cost effectiveness is estimated to be $32.95 per pound, or $65,899 per ton, of PM_{10} reduced.

Implementation Issues/Concerns

This analysis assumes that additional dust control at an affected facility will be gained through additional watering of haul roads and other actively disturbed areas. If other control techniques are used to reduce PM_{10} emissions, both the magnitudes of emission reduction and cost could change dramatically from the scenario considered in this analysis.

18. NOTIFY VIOLATORS MORE RAPIDLY TO PROMOTE IMMEDIATE COMPLIANCE

This measure would require inspectors that observe visible dust violations to inform on-site personnel so that corrective measures can be taken to eliminate activities causing the violation. Inspectors typically contact on-site staff at the time a NOV is issued about the need for corrective actions. Discussions with the County indicate that while this is the norm for industrial operations, it is frequently difficult to make contact with vacant lot property owners when visible land disturbance is discovered. Typically, no one is on the property at the time the disturbance is noted. Rule 310 provides 60 days for owners to stabilize disturbances on vacant lots, unpaved lots, etc. once they receive a letter notifying them of the violation. A NOV is only issued after the landowner fails to respond to the initial letter (i.e., 60 days after issuance of the letter). Discussions with the County indicate that frequently it takes time to identify the owner and resolve the problem. The response time is governed by the financial resources of the owner and their understanding of the options available to them to correct the violation.

The goal of this measure is to reduce the time available for compliance once violations have been identified. Any activity producing elevated emissions during winter months must be eliminated as soon as possible.

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

No estimate of the cost of the enforcement expense of implementing this measure is available. The cost of compliance depends on the form of stabilization chosen by the owner to eliminate the disturbance.

Emission Reduction

Unpaved parking lots are estimated to produce 3,009 tons per year in the 2005 PM_{10} nonattainment area. Windblown dust is estimated to produce 1,087 tons of PM_{10} in the 2005 inventory. No estimate of emissions from delayed compliance in these source categories is available.

Cost Effectiveness

The cost effectiveness of this measure depends on the form of stabilization selected to correct the violation. The minimum value is estimated to be $6,100 per ton of PM_{10} reduced (by using palliatives to stabilize unpaved parking lots, see Measure #32 – Pave or Stabilize Existing Unpaved Parking Lots) and the maximum value is estimated to be $239,050 per ton of PM_{10} reduced (by placing a rock barrier to eliminate trespass activity, see Measure #38 – Strengthen and Increase Enforcement of Rule 310.01 for Vacant Lots).

Implementation Issues/Concerns

While the benefits of this measure may contribute little to the Five Percent Plan, they will aid attainment at monitoring sites experiencing high wind exceedances. Education about control option alternatives may be the key to the successful implementation of this measure.

19. FULLY IMPLEMENT RULE 316

Maricopa County adopted Rule 316 in 1993 to control emissions from commercial, nonmetallic mineral processing plants and rock product plants. PM_{10} emissions from these facilities are generated during the mining, processing and handling (i.e., transporting, loading/unloading, conveying, crushing, screening, mixing and storing) of nonmetallic minerals. Unpaved roads and trackout are examples of area sources of PM_{10} emissions from facility operations. Historically, Rule 316 has contained only emission limitations that apply to industrial processes and not fugitive dust control measures specific to area sources located at nonmetallic mineral processing facilities. Facilities with area sources subject to Rule 316 have been required to comply with fugitive dust control measures in Rule 310.

Rule 316 was revised in 1999 to make the existing standards consistent with revisions to the Standards of Performance for Nonmetallic Mineral Processing Plants (40 CFR, Part 60, Subpart OOO). Revisions to Rule 316 were also adopted in 2005 to incorporate best available control measures (BACM) and most stringent measures (MSM) that were included in the Salt River State Implementation Plan (SIP). Revisions addressing industrial operations included process controls (i.e., enclosures, watering systems, operational overflow warning systems/devices and fabric filter baghouses) and process emission limitations (i.e., stack emission limitations). Revisions added to control emissions from fugitive dust sources, included:

- Applying dust suppressants;
- Installing and maintaining rumble grates, wheel washers, vehicle washers and truck washers;
- Installing and maintaining gravel pads from rumble grates and washers to facility exits;
- Paving from rumble grates to wheel washers and vehicle washers;
- Stabilizing haul/access roads and facility entries and exits;
- Stabilizing open storage piles and material handling;
- Ceasing active operations during a high wind event; and
- Cleaning paved internal roads.

The addition of the fugitive dust controls eliminated the need for sources subject to Rule 316 to comply with Rule 310 area source requirements. Revisions to Rule 316 underwent a formal rulemaking process which quantified the costs, benefits and cost

effectiveness of the proposed changes. Comments on those estimates were received and responded to in the final rulemaking.*

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

The Rulemaking presented estimates of the annualized cost required to implement the rule for three facility sizes:

- Large-Sized Facility – $101,314 - $116,067
- Medium-Sized Facility #1 – $92,755 - $107,508
- Medium-Sized Facility #2 – $86,717 - $101,469
- Small-Sized Facility – $22,653 - $44,976

Emission Reduction

The Rulemaking presented the following annual PM_{10} emission reduction estimates:

- Large-Sized Facility – 17.11 tons
- Medium-Sized Facility #1 – 11.7 tons
- Medium-Sized Facility #2 – 7.71 tons
- Small-Sized Facility – 0.61 tons

Cost Effectiveness

The Rulemaking presented the following estimates of cost effectiveness (i.e., $/ton of PM_{10} reduced):

- Large-Sized Facility – $4,802 - $5,501
- Medium-Sized Facility #1 – $6,417 - $7,347
- Medium-Sized Facility #2 – $9,126 - $10,678
- Small-Sized Facility – $30,087 - $59,750

Implementation Issues/Comments

Based on the emission reduction estimates presented in the Rulemaking, fully implementing Rule 316 will not significantly impact the required 5% per year emission

* Arizona Administrative Register, County Notices Pursuant to A.R.S § 49-112, Notice of Final Rulemaking, Maricopa County Air Pollution Control Regulations, Regulation III, Rule 316 – Nonmetallic Mineral Processing.

reduction requirements. These reductions, however, will significantly aid attainment at the monitors and a modeling demonstration of attainment.

20. REQUIRE PRIVATE COMPANIES TO USE PM_{10} CERTIFIED STREET SWEEPERS ON PAVED AREAS INCLUDING PARKING LOTS

During the field study of Salt River fugitive PM_{10} sources conducted in November and December of 2006, visible emissions were observed from vehicle travel over paved parking lots lightly covered with deposited soil. As a result of this observation, a request was made to evaluate the cost effectiveness of maintaining such paved parking lots and roadways by periodic sweeping with PM_{10}-efficient sweepers. This measure is identical to the control scenario analyzed in Measure #14 (Establish Maintenance Requirements for Paved Roads and Parking Lots).

Under this measure, all paved parking lots and roads would be swept at least every two weeks.

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

The periodic cost of sweeping was estimated from contract data received from the Maricopa County Department of Transportation. A 1-acre paved parking lot was selected for analysis as a typical example. The cost of bi-weekly sweeping of a 1-acre parking lot by a contract service was estimated to be $871 per year.

Emission Reduction

The emission reductions achieved by periodic sweeping were calculated as the difference in paved road travel emissions for surfaces with two different silt loadings. The activity level for unpaved parking published in the 2005 Maricopa County emission inventory of 100 vehicles per day per acre was used as a default activity level for this analysis. The average travel distance per parking cycle on a 1-acre lot was estimated to be the distance from one corner of a square lot to the center of the lot and back along travel links parallel to the sides of the lot (200 feet). The silt level of an unmaintained parking lot (0.60 g/m^2) was assumed to be twice that of the average Salt River street silt level measured and reported in the Salt River technical support document prepared by ADEQ in 2005. Sweeping by a PM_{10}-efficient sweeper was assumed to remove 86%, as measured in tests conducted by the University of California Riverside on sweepers seeking PM_{10}-efficient

certification. We also assumed that a completely cleaned parking lot (i.e., with 100% removal of surface silt) returned to pre-swept silt conditions in 10 days of use, from an engineering estimate published in a South Coast Air Quality Management District cost effectiveness analysis. On the basis of these assumptions, the emission reduction produced by sweeping a 1-acre parking lot every two weeks was calculated to be 5.4 pounds of PM_{10} per year.

Cost Effectiveness

The overall cost effectiveness is estimated to be $160.22 per pound, or $320,444 per ton, of PM_{10} reduced.

Implementation Issues/Comments

This analysis assumes a relatively low silt loading and low traffic levels on parking lots targeted for sweeping. Both of these values are based on engineering estimates. The use of higher values, if justified, would improve the calculated cost effectiveness of this measure.

21. SHIFT HOURS OF OPERATION DURING STAGNANT CONDITIONS IN NOVEMBER THROUGH FEBRUARY

This is a variant of Measure #13, Cease Dust Generating Operations During Stagnant Conditions. The difference is that instead of ceasing operations during the early morning hours that precede violations, participating facilities would start their daily operations after 9 am (the time at which inversions typically breakup) and extend their operations later in the day to offset the lost early morning hours. In contrast to Measure #13, this measure would produce no emission reductions, because operations would be shifted from one time period to another. Therefore, no benefits would accrue to the Five Percent Plan.

As noted in the discussion of Measure #13, participating facilities would need to be able to shift early morning operations on roughly 10 days per season (more if High Pollution Watch days are included). Effort will be required to determine which industries have the flexibility to shift operations during this time period. A variety of implementation issues would need to be investigated and defined to implement this measure, including minimum lead time notification requirements, emission density limits that would define the area of participation, compliance options, the need for tax credits to offset losses in efficiency, etc.

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

No estimates of the cost of developing, implementing or complying with this measure are currently available.

Emission Reduction

This measure will produce no reduction in emissions. However, the successful implementation of this measure would significantly enhance the probability of attainment at monitors located in areas with a history of exceedances.

Cost Effectiveness

Insufficient information is available to estimate the cost effectiveness of this measure.

Implementation Issues/Comments

Once agreement is reached on how to implement this measure, effort will be needed to define a communication mechanism which provides adequate lead time for companies to inform their staff that tomorrow's operations will be shifted.

22. MODEL CUMULATIVE IMPACTS FOR NEW OR MODIFIED EXISTING SOURCES

Currently, monitoring data recorded at the Durango Complex and West 43rd Avenue stations show violations of federal PM_{10} ambient air quality standards. When new facilities, or modifications of existing facilities, are proposed that would result in emissions increases exceeding 70 tons of PM_{10} per year (referred to as major sources), such emissions increases are required to be offset and a net benefit in air quality must be demonstrated. For new or modified sources that would produce emissions increases of less than 70 tons of PM_{10} per year (minor sources), no emissions offsets or demonstration of air quality benefit are required. Under this measure, all new or modified source applications would have to include air quality modeling of proposed emissions increases and emissions from existing nearby facilities to determine the cumulative air quality impacts in the area impacted by the new or modified source. If the modeling demonstrated that the federal PM_{10} ambient air quality standards would be violated, then the application must include emission reduction offsets sufficient to show no violations of standards.

The effect of this measure would be to require cumulative air quality modeling and emission offsets of new or modified sources in areas where modeling revealed violations of federal standards. Since the costs of modeling would be amortized over the life of the project, it is difficult to estimate an annualized cost effectiveness ratio for this component. The cost effectiveness of emissions offsets, however, can be estimated because these would be identical to the cost effectiveness of control measures that facility owners could undertake in the absence of governmental regulatory action. For example, if the proponent of a new minor facility were required to secure emission offsets equal to the proposed emissions of the new facility, that person could pave or treat public or private unpaved roads or parking areas in the immediate area to generate these offsets. The cost effectiveness of generating these offsets would be the cost effectiveness of the unpaved road or parking lot control technology.

We identified unpaved road dust palliative treatment as the most cost-effective source control that was available to a new facility proponent.

Cost Effectiveness

The overall cost effectiveness of this measure is estimated to be $0.07 per pound, and $141 per ton, of PM_{10} reduced resulting from the treatment of unpaved roads that carry more than 120 but less than 150 vehicles per day with lignosulfonate dust palliative.

Implementation Issues/Comments

This analysis assumes that unpaved roads of sufficient emissions are near any site proposed for construction and operation of a new minor source, such that modeling of source emission increases and unpaved road emission reductions can demonstrate no increase in PM_{10} concentrations. If other fugitive dust sources must be controlled to provide the needed offsets, then the cost effectiveness of this measure will be correspondingly higher.

23. CONDUCT NIGHTTIME AND WEEKEND INSPECTIONS

This measure is essentially the same as Measure #15, Conduct Nighttime Inspections, except that inspections would also occur on weekends. Currently, inspectors employed by the Maricopa County Air Quality Department (MCAQD) conduct inspections of permitted facilities – construction sites and mineral processing facilities – during normal work hours. Through interviews of mineral facility production staff, we learned that substantial mineral processing and construction activity occurs before daylight during the summer months to take advantage of cooler temperatures, especially for concrete pouring. Nighttime operations also occur to a lesser extent during winter months.

Under this measure, dust control inspections would be conducted during nighttime and weekend hours to assure compliance with Rule 310 during these periods. Because the 20% opacity limit in Rule 310 is very difficult to verify and enforce during nighttime hours, we assumed that inspections during these hours would involve use of portable dust monitors and the establishment of new fenceline PM_{10} concentration limits. We assumed that MCAQD would purchase DustTrak optical particle counters and pay inspectors a nighttime pay differential for working these hours. We also assumed that facility operators would increase the use of watering for additional dust control during nighttime hours if inspections found conditions of noncompliance.

The emission scenario we used in this analysis was a 50-acre residential construction site and that increased watering would involve the use of two additional water trucks during nighttime hours.

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

The costs of this measure include enforcement and dust control elements. We assumed that verification of compliance at night would be determined through spot monitoring with a portable optical particle counter. Amortized over an 8-year life, the monitor would cost $3.94 per 50-acre project, assuming that 200 projects were checked each year. Assuming that each project is inspected four times for two hours each by a MCAQD inspector paid a night differential rate, the additional night inspection costs were calculated to be $198.68 per project. We also estimated that processing 1 notice of violation per project would cost an additional $276.99 per project, for a total of

inspection and enforcement costs of $479.31 per project. The use of two additional water trucks during night work hours was estimated to cost $54,433 per project. (A 50-acre residential project is assumed to require 6 months to construct, from data contained in the WRAP Fugitive Dust Handbook.) The total cost of this measure was calculated to be $54,912 per project.

Emission Reduction

For baseline emissions, we assumed disturbed areas are watered every four hours, resulting in a control efficiency of 50%, which is close to the current effectiveness of Rule 310 as reported by MCAQD in 2007. By having two additional water trucks operate during nighttime hours, disturbed areas would be watered every 1.7 hours, resulting in a control efficiency of 79%. By applying these control efficiencies to the uncontrolled nighttime emissions of 17.9 tons per PM_{10}, we computed the emission reduction to be 3.8 tons of PM_{10} per 50-acre project.

Cost Effectiveness

The cost effectiveness of this measure was calculated to be $5.38 per pound, or $10,752 per ton, of PM_{10} reduced.

Implementation Issues/Concerns

This analysis assumes that additional dust control at an affected project will be gained through additional watering of actively disturbed areas. If other control techniques are used to reduce PM_{10} emissions, both the magnitudes of emission reduction and cost could change dramatically from the scenario considered in this analysis.

24. BAN OR DISCOURAGE USE OF LEAF BLOWERS ON HIGH POLLUTION ADVISORY DAYS

Leaf blowers are used for landscaping maintenance for both commercial and residential areas. They are used to blow away dirt, leaves, small rocks, etc., on landscaped areas and adjacent sidewalks, driveways, and roadways. While they improve the appearance of the landscape, they blow dust particles in the air and contribute to particulate pollution. They also produce exhaust emissions and generate high noise levels. Maricopa County estimates leaf blowers produced 843 tons of fugitive dust or 1% of the PM_{10} emitted annually within the nonattainment area in 2005.

This measure would involve restricting or prohibiting the use of blowers for landscaping maintenance in Maricopa County on days when monitors are expected to record a violation of the ambient PM_{10} standard.

Suggested Implementing Agency

Maricopa County and the MAG cities and towns could pass ordinances prohibiting or restricting the use of blowers on High Pollution Advisory Days within their jurisdictions.

Cost

The cost of implementing this measure depends on who is using a blower. Homeowners and full-time maintenance staff at large facilities (e.g., schools, large parks, etc.) can simply delay their use of blowers to another day at no cost. In contrast, contractors who must travel from job to job may incur a cost depending on how they choose to comply with this restriction. Their options to comply include cleaning the job site manually, returning on the next available non-Advisory Day, or returning only on the next regularly scheduled maintenance day. The only option that incurs a cost is the one requiring an unscheduled return to use the blower. This option was estimated to have a cost of $23 per day per residence.

Emission Reduction

The benefits of this measure depend on whether the use of the blower on the advisory day is completely foregone until the next regularly scheduled maintenance day or whether it is made up on a subsequent non-advisory day. If the blowing activity is made up (i.e, the contractor comes back the next non-advisory day to complete the blowing portion of the job), there is no annual emissions benefit from this measure since it has been delayed

from one day to another. If the blowing activity on the advisory day is foregone until the next regularly scheduled maintenance day, an annual emission reduction benefit would accrue. The benefit of foregone blowing is estimated to be 2.1 lbs per day per residence.

There is one other option to comply with this measure, that is, choosing to use a broom rather than a blower to clean paved surfaces. Emission testing by U.C. Riverside,* however, indicates that brooming on concrete produces fugitive dust emissions that are equivalent to those of leaf blowing.

Cost Effectiveness

The only scenario under which a cost-effectiveness estimate can be calculated is for the loss of emissions on an advisory day and under the assumption that the homeowner has to pay for the extra non-advisory visit. Under these conditions, the cost effectiveness of this measure is estimated to be $10.93/lb or $21,851/ton of PM_{10}.

Implementation Issues/Comments

Given the options for compliance and the dispersed nature of the activity, this measure would be very problematic to enforce and the benefits highly uncertain.

* Determination (sic) Particulate Emission Rates from Leaf Blowers, University of California Riverside and San Joaquin Valley Air Pollution Control District, presented at the 15th International Emission Inventory Conference, New Orleans, May 2006.

25. ENCOURAGE USE OF LEAF VACUUMS TO REPLACE BLOWERS

Leaf blowers are used for landscaping maintenance for both commercial and residential areas. They are used to blow away dirt, leaves, small rocks, etc., on landscaped areas and adjacent sideways, driveways, and roadways. While they improve the appearance of the landscape, they blow dust particles into the air and contribute to particulate pollution. They also produce exhaust emissions and generate high noise levels. Maricopa County estimates leaf blowers produced 843 tons of fugitive dust or 1% of the PM_{10} emitted annually within the nonattainment area in 2005.

This measure would involve encouraging the use of leaf vacuums to replace the use of blowers for landscaping maintenance in Maricopa County.

Suggested Implementing Agency

Maricopa County and the MAG cities, towns, school districts and community colleges could provide leadership on this measure and replace blowers with vacuums in their maintenance and clean-up operations. They could also pass an ordinance mandating the phase out and replacement of blowers over a suitable time period.

Cost

Based upon discussions with vendors, the analysis assumed that the purchase price of the typical 3 hp leaf vacuum to be $275 and that a vacuum has an average life of three years. The operating expenses are estimated to be $135 per year; this estimate, however, was not included in the analysis since it is roughly equivalent to the cost of operating existing blowers. No attempt was made to quantify the cost of enforcing this ordinance.

Emission Reduction

Previous analysis of this measure assumed collection efficiency of the vacuum bag was assumed to be 98%. This estimate was based on the collection efficiency of industrial fabric filters. Recent testing conducted by U.C. Riverside* found that particulate emissions from leaf vacuums are equal to those of leaf blowers even for particles as large

* Determination (sic) Particulate Emission Rates from Leaf Blowers, University of California Riverside and San Joaquin Valley Air Pollution Control District, presented at the 15th International Emission Inventory Conference, New Orleans, May 2006.

as 100 microns in diameter. It appears that leaf vacuum bags are not designed to collect dust.

Cost Effectiveness

The cost effectiveness of this measure is infinite since the emission reduction is zero.

Implementation Issues/Comments

The lack of an emissions benefit invalidates this measure.

26. REDUCE OFF-ROAD VEHICLE USE IN AREAS WITH HIGH OFF-ROAD VEHICLE ACTIVITY

The City of Goodyear recently implemented an ordinance* banning the use of off-highway vehicles (OHVs) and all terrain vehicles (ATVs) on unimproved property without the written permission of the property owner. The ordinance was implemented to address numerous complaints about problems caused by OHVs and ATVs operating in the Gila River bed and other desert areas within the City's boundaries. The complaints raised concern about the following impacts:

- Dust clouds significantly reduced drivers visibility on the roads;
- Unhealthy impacts of dust and odor on those with allergies and other medical problems;
- Ecological damage caused by oil, gasoline, tracks and debris; and
- Excessive noise.

The City was also concerned that it could be liable for fines of up to $10,000 per day for failing to comply with Maricopa County Air Quality Regulations regulating fugitive dust.

The enforcement effort that accompanied the implementation of the ordinance included:

- The preparation and distribution of a brochure entitled "Let's make it clear, Information on the use of all-terrain vehicles (ATVs) and off-highway vehicles (OHVs) in the desert areas in the City of Goodyear."

- Purchase of an off-road vehicle for use by the Police Department to enter areas where OHVs and ATVs were being operated.

- Installation of signs notifying OHV's and ATV's operators of the new ordinance.

- Allocation of staff time to provide a visible enforcement presence in areas where OHVs and ATVs were being operated.

The ordinance makes it unlawful for any person to operate or drive any motor vehicle, motorcycle, minibike, dune buggy, ATV, motor scooter, or other form of transportation propelled by an internal combustion engine on private or public property without prior written permission of the owner of the property. A violation of this requirement is a

* Goodyear Ordinance 2006-981 Section 11-1-24.

misdemeanor offense with a fine of up to $2,500 and/or imprisonment for a period of up to six months.

Discussions with the Chief of the Police indicate that OHV and ATV riders/operators terminated activity within the city boundaries once it became clear the ordinance was being enforced. The approach used to implement the ordinance was to distribute brochures, meet with riders/operators in the field and explain the new requirements and have a visible presence with a vehicle able to chase violators. No extra staff time was required to implement the ordinance and no arrests were made.

Suggested Implementing Agency

This measure would be implemented by Maricopa County, cities and towns.

Cost

The principal cost components of implementing this measure include the purchase price of the off-road vehicle by the Police Department ($12,000) and the annual distribution of the brochure to residents (estimated to be $7,500 per year). Since the City of Goodyear has 7,934 acres of open space, the annualized cost/per year of enforcing this measure is estimated to be $1.31 per acre.

Emission Reduction

The 2005 PM_{10} emission inventory estimates that off-road recreational vehicles produced 2,159 tons of PM_{10} in the nonattainment area. Based on the ratio of open space acreage in the City of Goodyear to the total acreage of the nonattainment area, the City of Goodyear was responsible for 45.3 tons of off-road recreational PM_{10} emissions. The ordinance appears to have eliminated all of those emissions from within the City's boundaries.

Cost Effectiveness

The cost effectiveness of this measure is estimated to be $230 per ton of PM_{10} reduced.

Implementation Issues/Comments

While the City of Goodyear has effectively eliminated off-road emissions within its borders, it is not clear that this activity has been eliminated from within the boundaries of the nonattainment area. The cost effectiveness of this measure and the magnitude of the emissions from the targeted activity make this an attractive measure for implementation. However, in order for reductions to be realized, the measure would need to be implemented throughout the nonattainment area so that off-road activity is effectively shifted outside of nonattainment area boundaries.

27. CREATE FUND TO PROVIDE INCENTIVES TO RETROFIT NONROAD DIESEL ENGINES AND ENCOURAGE EARLY REPLACEMENT WITH ADVANCED TECHNOLOGIES

Programs that provide financial incentives for reducing PM emissions from nonroad Diesel engines through voluntary retrofit of emission control systems or repowering of equipment with newer engines have been conducted in a number of areas. California's Moyer Program provides one example* and materials related to the design and implementation of such programs are available from the Western Regional Air Quality Partnership.† In general, these programs require a funding source that distributes funds for repower/retrofit projects that meet specific criteria. There are a wide range of nonroad Diesel engines used in a variety of applications that could be retrofitted or repowered, as well as potential criteria that could be used to determine which engines should be retrofit. Given this, a comprehensive assessment of this measure was not feasible.

In order to illustrate the potential emission benefits, costs, and cost effectiveness of such programs, a measure involving voluntary repowering or retrofitting of Tier 0 (pre-1998 model year) off-road Diesel construction equipment was evaluated. Repower was assumed to be by engines that meet the U.S. EPA's Tier 3 emission standards. Retrofit was assumed to be by either Diesel Oxidation Catalyst (DOC) or Diesel Particulate Filter (DPF). It was also assumed that the fund created would be sufficient to allow for either the repower or retrofit of 500 engines used in tractors, loaders, and backhoes and that the average unit affected is rated at 160 horsepower. Note that equipment retrofit will also necessitate the use of ultra-low sulfur Diesel fuel and will result in a fuel consumption penalty due to increased exhaust system backpressure.

The following table shows the estimated percentage reduction in $PM_{2.5}$ emissions as well as emissions of other regulated pollutants. Reductions associated with repower were estimated using the NONROAD model, while estimates for the emission reductions associated with retrofit were developed from information published by U.S. EPA and CARB regarding verified devices. ‡

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* See *http://www.arb.ca.gov/msprog/moyer/moyer.htm.*

† See *http://wrapair.org/forums/msf/index.html.*

‡ See *http://www.epa.gov/otaq/retrofit/retroverifiedlist.htm, http://www.epa.gov/otaq/retrofit /retropotentialtech.htm* and *http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm*

Technology	$PM_{2.5}$ Reduction	VOC Reduction	CO Reduction	NOx Reduction
Tier 3 Repower	55%	75%	75%	70%
Diesel Particulate Filters (DPFs)	85-90%	50-90%	50-90%	0
Diesel Oxidation Catalysts (DOC)	20-30%	50-90%	50-90%	0

Implementing Agency

This measure could be implemented by cities, towns, Maricopa County, and the Arizona Department of Transportation.

Costs

Repowering was estimated to cost $16,000 with an additional $6,000 for installation.* A summary of the cost for retrofits is shown in the following table. The cost for DPFs is estimated at $4,000 per vehicle based on an average bus retrofit cost of $7,500, which was scaled downward to account for the lower horsepower rating of the nonroad engines (300 hp for buses versus 160 horsepower for the nonroad equipment).† The cost for DOCs is estimated to be $800 per vehicle based on an average bus retrofit cost of $1,500 (again scaled downward).‡ In addition to the cost of the retrofit devices, there are costs associated with fuel economy penalties due to the retrofit devices. The estimated fuel economy penalties based on mid-range estimates published by the U.S. EPA§ for DPFs and DOCs are also shown in the following table.

Technology	Avg Retrofit Cost	Additional Costs
Diesel Particulate Filter (DPF)	$4,000	~3% fuel economy penalty
Diesel Oxidation Catalyst (DOC)	$800	~1% fuel economy penalty

Costs for repower were amortized over a ten-year life using a discount rate of 7%. Retrofit costs were amortized over a five-year life using a discount rate of 7% and Diesel fuel was assumed to cost $2.50 per gallon.

* California Air Resources Board, "The Carl Moyer Memorial Air Quality Standards Attainment Program Guidelines," September 30, 2003.

† U.S. Environmental Protection Agency, "Technical Highlights, Questions and Answers on Using a Diesel Particulate Matter Filter in Heavy-Duty Trucks and Buses," Report No. EPA420-F-03-017, June 2003.

‡ U.S. Environmental Protection Agency, "Technical Highlights, Questions and Answers on Using a Diesel Oxidation Catalyst in Heavy-Duty Trucks and Buses," Report No. EPA420-F-03-016, June 2003.

§ See *http://www.epa.gov/otaq/retrofit/retropotentialtech.htm.*

Benefits

The emission reductions associated with the repower of 500 pieces of Tier 0 construction equipment with Tier 3 engines were estimated using the NONROAD model for calendar year 2010. Repower is estimated to reduce $PM_{2.5}$ emissions by 0.03 tons per day. Similarly, the NONROAD model was used to estimate the emission benefits associated with retrofit. The average control efficiency of DPFs and DOCs was assumed to be 85% and 25%, respectively, and estimated $PM_{2.5}$ reductions are 0.04 and 0.01 tons per day.

Cost Effectiveness

Based on the emission reductions and cost estimates discussed above, the average cost-effectiveness ratio for repower was estimated to be $150,000 per ton of $PM_{2.5}$ emissions eliminated. Assuming a cost of $2.50 for nonroad Diesel fuel, an incremental cost of 5 cents per gallon for ultra-low sulfur Diesel fuel, and an average fuel usage rate of 4,000 gallons per year, in combination with the retrofit cost numbers shown above, the cost effectiveness was estimated to be $44,000 and $52,000 per ton of $PM_{2.5}$ emissions eliminated for DPFs and DOCs, respectively.

Implementation Issues

Care must be taken to ensure that retrofit devices are used for verified/appropriate vehicle applications.

28. UPDATE THE STATUTES TO REQUIRE ULTRA-LOW SULFUR DIESEL FUELS FOR NONROAD EQUIPMENT

Control Measure Description

Arizona Revised Statutes section 41-2083J requires that all Diesel fuel sold in area A comply with a 500 ppm maximum sulfur content limit. Federal regulations contained in Subpart I of Part 80, Title 40 Code of federal regulations also impose limits on the sulfur content of Diesel fuel sold throughout the United States. At present, these regulations restrict the sulfur content of Diesel fuel sold in on-road vehicles to 15 ppm and will impose a similar limit on Diesel fuel sold for use in nonroad vehicles other than locomotives and marine vessels beginning in June 2010. Fuel used in locomotives and marine vessels must meet the 15 ppm sulfur limit beginning in June 2012. Under this measure, section 41-2083J would be revised to require that ultra-low sulfur Diesel fuel (i.e., 15 ppm) be used in nonroad equipment. For purposes of this evaluation, it was assumed that the revised statutes would be effective on January 1, 2008.

Implementing Agency

This measure would be implemented by the Arizona Department of Environmental Quality.

Costs

The U.S. EPA has estimated that compliance with the 15 ppm requirement for on-road engines will increase refining costs by 4 cents per gallon and that the total price increase associated with the 15 ppm sulfur restrictions for nonroad Diesel in the southwestern U.S. (PADD 5) will range from 5 to 7 cents per gallon.* However, as noted in the Implementation Issues section below, the actual costs may be higher depending on the availability of 15 ppm Diesel fuel during the 2007 to 2010 period.

Benefits

This control measure will reduce emissions of sulfur oxides from nonroad Diesel equipment. Assuming that the sulfur content of fuel complying with the current 500 ppm limit is actually about 450 ppm, the reduction in fuel sulfur content due to the measure will be approximately 435 ppm. Based on the U.S. EPA's NONROAD Model (version

* See Section 7 of the Regulatory Impact Analysis at *http://www.epa.gov/nonroad-diesel/2003nprm.htm.*

2005a, Feb. 2006), annual Diesel fuel consumption in Maricopa County by nonroad equipment and vehicles, except locomotives and marine vessels, will be as follows:

2008 - 171,994,675 gallons
2009 - 176,184,778 gallons
2010 - 180,374,871 gallons

Using these figures, an assumed density of 7 pounds per gallon for Diesel fuel, and assuming that 95% of sulfur is converted to SO_2 and 5% to sulfate, the emission reductions due to the control measure are approximately 1.4 tons per day of SO_2 and 0.1 ton per day of directly emitted sulfate. No direct PM emission reductions other than the reduction in sulfate are expected from the use of ultra-low sulfur Diesel fuel in nonroad equipment, although its use will facilitate retrofit of particulate control devices such as traps and Diesel oxidation catalysts.

Cost Effectiveness

Based on the emission reductions quantified above, and an assumed cost of 5 cents per gallon, the cost effectiveness of the proposed control measure is $16,000 per ton of SO_2 and sulfate emissions eliminated.

Implementation Issues

The refining industry has indicated that there may be supply issues associated with the distribution of 15 ppm Diesel fuel as the federal requirements applicable to on- and nonroad vehicles become effective. To the extent that supply issues arise, costs could be much higher than estimated.

29. SWEEP STREETS WITH PM_{10}-CERTIFIED STREET SWEEPERS

Although most of the new street sweepers purchased in the Maricopa area in the past several years have be certified as PM_{10}-efficient, there are no local requirements that all new sweepers be certified. This measure proposes that all new sweepers be certified as PM_{10}-efficient. In the evaluation of cost effectiveness for this measure, we assumed that a jurisdiction was able to choose between a non-certified and a certified unit in replacing an existing street sweeper. We also assumed that a new street sweeper would be used to clean all four lanes of arterial streets, and that streets would be swept every two weeks.

Suggested Implementing Agency

This measure would be implemented by Maricopa County and the cities within the PM_{10} nonattainment area.

Cost

The cost of this measure includes only the differential in purchase price between a certified PM_{10}-efficient sweeper and a non-certified unit. We assumed that there are no differences in operations and maintenance costs or life expectancy for the two types of units. Finally, we assumed that a new sweeper would clean 7.5 centerline-miles per day of 4-lane arterial roads, or a total of 75 centerline-miles of street every 10 working days (the total work days in a two week sweeping interval). The difference in purchase price was estimated to be $649 per year as amortized over the 8-year useful life of a sweeper. This difference equated to $8.66 per year per centerline-mile of street.

Emission Reduction

Emission reductions were computed as the difference in PM_{10} emissions for a typical Salt River arterial street cleaned by each of the two types of sweepers. A PM_{10}-efficient sweeper was estimated to reduce street silt levels by 86%, and a non-certified unit was estimated to reduce silt levels by 55%, based on sweeper tests conducted for the South Coast AQMD sweeper certification program by the University of California Riverside. Streets were assumed to return to equilibrium silt conditions in 10 days after being completely cleaned based on a 1998 South Coast AQMD estimate. We used this information to estimate that silt loadings after a sweeping would rise by 10% of pre-swept levels per day until equilibrium levels were attained. Based on Salt River arterial

silt loadings, the emission reductions were calculated to be 11.9 pounds per day, or 2.16 tons per year, of PM_{10} reduced.

Cost Effectiveness

The cost effectiveness of this measure was calculated to be $0.002 per pound, or $4.00 per ton, of PM_{10} reduced.

Implementation Issues/Concerns

This analysis assumes that the maximum equilibrium return period of silt levels on a completely cleaned street is 10 days. Some evidence exists to suggest that the return period is much shorter, which would diminish the emission reductions calculated for use of a certified sweeper versus an uncertified unit.

30. RETROFIT ON-ROAD DIESEL ENGINES WITH PARTICULATE FILTERS

Control Measure Description

A number of programs have been implemented involving the voluntary or mandatory retrofit of on-road heavy-duty Diesel trucks (HDDTs) with PM control devices. The measure involves the retrofit of 1,000 pre-2007 model year heavy-duty Diesel trucks (HDDTs) with Diesel PM filters (DPFs) and Diesel oxidation catalysts (DOCs). The table below shows the range of potential emission benefits associated with DPFs and DOCs that have been verified by the U.S. EPA and CARB as being capable of reducing Diesel PM emissions.*

Technology	$PM_{2.5}$ Reduction	VOC Reduction	CO Reduction
Diesel Particulate Filters	85-90%	50-90%	50-90%
Diesel Oxidation Catalysts	20-30%	50-90%	50-90%

Implementing Agency

This measure could be implemented by cities, towns, Maricopa County, and the Arizona Department of Transportation.

Costs

A summary of the cost for retrofits is shown in the following table. The cost for DPFs is estimated at $11,875 per vehicle based on an average bus retrofit cost of $7,500, which was scaled up to account for the higher horsepower rating of HDDT engines.† The cost for DOCs is estimated to be $2,375 per vehicle from average bus retrofit cost of $1,500 (again scaled up for HDDTs).‡ In addition to the cost of the retrofit devices, there are costs associated with fuel economy penalties due to the retrofit devices. These penalties arise from increases in exhaust system backpressure caused by installation of the devices.

* See *http://www.epa.gov/otaq/retrofit/retroverifiedlist.htm*, *http://www.epa.gov/otaq/retrofit/retropotentialtech.htm* and *http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm*.

† U.S. Environmental Protection Agency, "Technical Highlights, Questions and Answers on Using a Diesel Particulate Matter Filter in Heavy-Duty Trucks and Buses," Report No. EPA420-F-03-017, June 2003.

‡ U.S. Environmental Protection Agency, "Technical Highlights, Questions and Answers on Using a Diesel Oxidation Catalyst in Heavy-Duty Trucks and Buses," Report No. EPA420-F-03-016, June 2003.

The estimated fuel economy penalties based on mid-range estimates published by the U.S. EPA* for DPFs and DOCs are also shown in the following table.

Technology	Avg Retrofit Cost	Additional Costs
Diesel Particulate Filter (DPF)	$11,875	~3% fuel economy penalty
Diesel Oxidation Catalyst (DOC)	$2,375	~1% fuel economy penalty

Costs were amortized over a five-year useful life using a discount rate of 7%. Diesel fuel was assumed to cost $2.50 per gallon, and average fuel economy and annual VMT of retrofit HDDTs were assumed to be 4.6 miles per gallon and 70,000 miles, respectively.

Benefits

The emission reductions associated with the retrofit of 1,000 pre-2007 model year HDDTs with either DPFs or DOCs were estimated. Average emission factors for pre-2007 HDDTs were developed from MOBILE6.2 using calendar year 2010. Annual average mileage was assumed to be 70,000 miles and it was assumed that retrofit vehicles were operated exclusively in the MAG region. The average control efficiency of DPFs and DOCs was assumed to be 85% and 25%, respectively, and estimated $PM_{2.5}$ reductions were 0.083 and 0.024 tons per day.

Cost Effectiveness

Based on the emission reductions and cost estimates discussed above, the average cost-effectiveness ratios were estimated to be $107,000 and 133,000 per ton of $PM_{2.5}$ emissions eliminated for DOCs and DPFs, respectively.

Implementation Issues

Care must be taken to ensure that retrofit devices are used for verified/appropriate vehicle applications.

* See *http://www.epa.gov/otaq/retrofit/retropotentialtech.htm.*

31. REPAVE OR OVERLAY PAVED ROADS WITH RUBBERIZED ASPHALT

The City of Phoenix originally pioneered the use of rubberized asphalt to recycle waste tires in 1964 when it was incorporated into a "chip seal" program for city streets. Improvements in durability were offset by concerns about potential vehicle damage from loose chips and the program was discontinued in 1989. At about the same time, both the city and the state began incorporating rubber from recycled waste tires into a hot asphalt mix that was used to resurface roads. Subsequent research has shown that rubberized asphalt has many additional benefits, including reduced tire noise, increased skid resistance, improved surface drainage and more recently reduced tire wear.

Tire wear is a component of PM_{10} emitted from motor vehicles. Other components include vehicle exhaust, brake wear and re-suspended road dust. According to EPA's mobile source emission factor model, MOBILE6, PM_{10} from tire wear is emitted at a rate of 0.010 g/mi (for the mix of vehicles operating in the nonattainment area). Based on information presented in the Salt River PM_{10} Emissions Inventory, emission factors for the other components are all higher, including:

- Fugitive Dust – 0.30 g/mi
- Exhaust – 0.065 g/mi
- Brake Wear – 0.013 g/mi

Information on reductions in tire wear emissions was obtained from an Arizona Sate University study* that contrasted emissions from rubberized asphalt with portland cement concrete (PCC). The results of that study indicate that emission rates of tire wear on rubberized asphalt are 30-50% lower than they are on PCC. This is a comparison that represents the benefits of rubberized asphalt used as an overlay to extend the life of PCC freeways. No information was found to provide a similar comparison of benefits on arterial and local roads, which more typically use conventional asphalt.

Suggested Implementing Agency

This measure could be implemented by cities, towns, Maricopa County, and the Arizona Department of Transportation.

* Tire Wear Emissions from Asphalt Rubber and Portland Cement Concrete Pavement Surfaces, Arizona State University, Final Report, April 2006.

Cost

Information was requested on the marginal cost of resurfacing PCC with conventional asphalt or related maintenance procedures, but has not yet been received. According to ADOT, the average cost of laying rubberized asphalt is $1.1 million per mile (6 lanes) or approximately $183,333 per lane mile.

Emission Reduction

Assuming a freeway comparison with an average daily traffic (ADT) of 17,000 vehicles per lane mile, the emission reduction of using rubberized asphalt is estimated to be 0.034 tons per mile per year. At a lower ADT level of 2,500 vehicles per lane mile, the emission reduction drops to 0.005 tons per mile per year.

Cost Effectiveness

The cost effectiveness of resurfacing freeways with rubberized asphalt is estimated to $630,882/ton of PM_{10} reduced. Assuming similar resurfacing costs, the cost effectiveness for roads with lower ADT levels would be $4,290,000/ton of PM_{10} reduced.

Implementation Issues/Comments

While the cost effectiveness of this measure may be improved with information on the marginal cost of resurfacing with rubberized asphalt (i.e., versus other methods), the cost effectiveness of this measure is moot. This is because the Regional Transportation Plan (RTP)* includes commitments to fund mitigation projects which include rubberized asphalt overlays. Thus, this measure is already being implemented and credit for the emission reductions attributed to it should be credited toward the 5% per year emission reductions. Unfortunately, the emission benefits of this measure are limited due to the low emission rate of tire wear.

* 2006 Annual Report on the Status of the Implementation of Proposition 400, Maricopa Association of Governments, August 2006.

32. PAVE OR STABILIZE EXISTING UNPAVED PARKING LOTS

Unpaved parking areas contribute to the particulate pollution problem through two separate processes: (1) the production of fugitive dust as vehicles travel over an unpaved surface; and (2) trackout of material onto adjacent paved surfaces, including parking lots, driveways, and public roadways, where it is subsequently crushed by moving vehicles and re-entrained into the air by trailing vehicle wakes. Maricopa County has estimated that unpaved parking lots produced 3,009 tons or 3% of the PM_{10} emitted annually within the nonattainment area in 2005. This estimate did not include any benefit for Rule 310.01; it assumes that emissions from unpaved parking lots are uncontrolled. While this may be an overestimate of the emissions, the recent analysis of Rule 310.01 effectiveness did not address unpaved parking lots (the focus instead was on vacant lots), so the level of enforcement in 2005 is unclear.

Currently Rule 310.01 requires the owner and/or operator of an unpaved lot to implement one of the following control methods:

- Pave;
- Apply dust suppressants; or
- Uniformly apply and maintain surface gravel.

The non-paving measures are subject to stabilization and opacity limitations; these limitations do not apply to paving. This measure would apply City of Phoenix zoning requirements for off-street parking to unpaved parking lots throughout the nonattainment area. All parking and maneuvering areas on residential, commercial and industrial property, with the exception of single-family homes or duplexes, would be required to have dustproof paving using one of the following options: asphaltic concrete, cement concrete, chip seal, or an equivalent. Single-family homes or duplexes can comply by applying a smooth layer of crushed rock or equivalent surface treatment.

Suggested Implementing Agency

This measure would be implemented by Maricopa County, cities and towns.

Cost

Cost was separately evaluated for paving and dust palliative application for non-single family homes or duplexes. Each alternative was evaluated for a 0.10-acre parking lot, which is the maximum size exempt from treatment under Rule 310.01. The annualized cost of paving, since paving is assumed to last for 25 years, is $1,699/year. The annualized cost of dust palliatives, assuming annual grading and palliative application, is $101 per year. No additional effort or cost was assumed to implement this rule.

Emission Reduction

The paving option is estimated to produce a reduction of 94 lbs of PM_{10} per year. The palliative option is estimated to produce a reduction of 33 lbs of PM_{10} per year.

Cost Effectiveness

Paving is estimated to have a cost effectiveness of $18.10/lb or $36,204/ton of PM_{10} reduced; palliatives are estimated to have a cost effectiveness of $3.06/lb or $6,119/ton of PM_{10} removed.

Implementation Issues/Comments

This analysis needs to be updated to include enforcement costs, because considerable effort would be required to achieve a high level of rule effectiveness.

33. PAVE OR STABILIZE EXISTING DIRT ROADS AND ALLEYS

Fugitive dust emissions occur whenever a vehicle travels over an unpaved surface. Unlike paved roads, however, the road is the source of emissions rather than any surface dust loading. Although unpaved roads and alleys generally receive much lower traffic than paved facilities, their greater PM_{10} emission rate causes them to produce high levels of fugitive dust. Vehicles transitioning from unpaved to paved surfaces can also trackout material onto paved surfaces that can be re-entrained by subsequent traffic. Wind erosion of dust from unpaved surfaces can also add to the total fugitive dust emissions.

Maricopa County estimates that unpaved roads produce 8,490 tons or 9.3% of the PM_{10} emitted within the nonattainment area in 2005. This estimate assumes that all commitments to pave unpaved roads contained in the Serious Area PM_{10} Plan were implemented. No benefit from Rule 310.01 is included. This estimate assumes that emissions from unpaved roads are uncontrolled. While this may be an overestimate of the emissions, the recent analysis of Rule 310.01 effectiveness did not address unpaved roads (the focus instead was on vacant lots), so the level of enforcement in 2005 is unclear.

Currently, Rule 310.01 requires emissions from unpaved roads (including alleys) with traffic levels exceeding 150 vehicles per day to be controlled by one of the following methods:

- Pave;
- Apply dust suppressants; or
- Uniformly apply and maintain surface gravel.

The nonpaving measures are subject to stabilization and opacity limitations. These limitations are not applicable to unpaved roads that have been paved. This measure would extend Rule 301.01 requirements to unpaved roads with traffic levels below 150 vehicles per day.

Suggested Implementing Agency

This measure could be implemented by cities, towns, Maricopa County, and Arizona Department of Transportation.

Costs

No estimate of additional enforcement activity or cost is assumed to implement this measure. According to tests conducted in 1995 by MCDOT, the most cost effective palliative is Ligno 10, which has an annual cost of $3,052/mile. The analysis assumes that four applications per year are required to provide sufficient control for high volume unpaved roads (i.e., 120 vehicles per day).

Emission Reduction

The MCDOT study computed a control efficiency of 67.3% compared to uncontrolled conditions when applied four times per year. This measure was assumed to be applied to the higher-traffic unpaved roads included in the 2005 Periodic Emission Inventory, which had traffic levels of 120 vehicles per day. This measure was estimated to produce a reduction in fugitive dust emissions of 21.7 tons per mile per year.

Cost Effectiveness

The overall cost effectiveness of this measure is estimated to be $0.07/lb or $141/ton.

Implementation Issues/Comments

Unlike Measure #5, no field effort is assumed to identify high-volume roadways for stabilization. Stabilizing roads will make it easier to drive faster and raise speed control and liability issues. Before this measure can be implemented, data on traffic volumes will have to be collected to identify candidate roads for stabilization.

34. LIMIT SPEEDS TO 15 MILES PER HOUR ON HIGH TRAFFIC DIRT ROADS

Dust emissions from unpaved road travel increase as vehicle speed increases. According to EPA's AP-42 emission factor for unpaved road travel, fugitive dust emissions increase by a factor of 1.41 (i.e., the square root of 2) when speed is doubled. The emission inventory developed by Maricopa County for 2005 assumes that vehicles traveled at an average speed of 25 mph on unpaved roads and produced 8,490 tons or 9.3% of the PM_{10} emitted within the nonattainment area. At present, speeds on unpaved public roads are uncontrolled.

Regulated facilities are required to consider the impact of speed on fugitive dust emissions on unpaved roads. Rule 310 requires owners and/or operators of unpaved haul or access roads that have not been stabilized to limit vehicle speeds to no more than 15 miles per hour. This measure would extend those requirements to unpaved roads accessible to the public with traffic levels above 120 vehicles per day.

Discussions with MCDOT indicate that liability concerns moot the use of speed bumps to limit speeds and encourage the use of paved roads. Enforcement options therefore include installing signs posting speed limits at regular intervals (e.g., ¼ mile) and use of radar guns to measure speed of oncoming vehicles.

Suggested Implementing Agency

This measure could be implemented by cities, towns, Maricopa County, and Arizona Department of Transportation.

Cost

Costs were estimated for installing signs and enforcing speed limits on selected segments of high traffic (i.e., 120+ vehicles per day) unpaved county roads. The annualized signage cost assuming signs every ¼ mile with a useful life of 15 years is $142/road mile per year. The annualized cost of enforcement assumes that a deputy sheriff with a radar gun monitors the selected unpaved roads and issues an estimated four tickets per day. The annualized enforcement cost is $8,211/road mile per year.

Emission Reduction

The benefit of limiting speed from 25 mph to 15 mph on unpaved roads would be a 22.5% reduction in fugitive dust emissions. When applied to roads with more than 120 vehicles per day, this measure, which assumes an in-use compliance factor of 70%, would reduce fugitive dust emissions by 9.29tons/road mile per year.

Cost Effectiveness

The overall cost effectiveness of this measure is estimated to be $0.45/lb, or $899/ton of PM_{10} reduced.

Implementation Issues/Comments

MCDOT has concluded from past experience that the changing conditions of unpaved roads makes proper and realistic posting of speed limits "near impossible." This position is consistent with what the state and other counties are doing.

35. PROHIBIT NEW DIRT ROADS, INCLUDING THOSE ASSOCIATED WITH LOT SPLITS

Unpaved roads are a significant source of fugitive dust emissions in the nonattainment area. Maricopa County estimates that unpaved roads produce 8,490 tons or 9.3% of the PM_{10} emitted within the nonattainment area in 2005. While controls are required for existing unpaved roads, there is no prohibition on the construction of new unpaved roads or the expansion of existing unpaved roads.

Clark County began prohibiting the construction of new unpaved roads or alleys in public thoroughfares in calendar year 2000 unless the unpaved road is an interim component of an active paving project. San Joaquin Valley started prohibiting the construction of new unpaved roads in urban areas in 2004. New unpaved roads cannot be constructed in urban areas unless the road is to be used for a temporary activity that does not exceed six months of use over a consecutive three-year period. Temporary activities are defined to include construction access roads, special events, or traffic detours. The surface of roads meeting this definition must be maintained in a stabilized condition at all times in order to control fugitive dust emissions.

Each year funds are allocated for paving and stabilizing the existing inventory of unpaved roads. The implementation of this measure will place a cap on the growth of unpaved roads and ensure that emissions from vehicles operating on them will diminish over time.

Suggested Implementing Agency

This measure would be implemented by Maricopa County, cities and towns.

Cost

The only option evaluated for this measure is paving. The annualized paving cost is estimated to $44,067/mile per year. This estimate includes costs for roadway excavation, aggregate base, asphalt paving, striping, and traffic control.

Emission Reduction

The emission benefit is 33,308 lbs/mile per year, or 16.7 tons/mile per year of PM_{10} reduced.

Cost Effectiveness

The cost effectiveness is estimated to be $1.32/lb of PM_{10} reduced, or $2,646/ton.

Implementation Issues/Comments

The high capital outlay for paving may encourage developers to instead opt to stabilize new roads and pass the long-term cost of maintenance onto home owners, which would then require additional enforcement effort to assure compliance.

36. PAVE OR STABILIZE UNPAVED SHOULDERS

Direct and indirect emissions from vehicle travel on the untreated shoulders of paved roads are a significant source of PM_{10} emissions in the Maricopa County nonattainment area. Direct emissions are generated when vehicles travel on unpaved shoulders and when trucks moving at moderate speeds produce bow wakes that entrain loose dust on shoulder surfaces into the air. Indirect emissions are generated when vehicles crossing from unpaved shoulders onto paved lanes track soil onto the pavement that is subsequently crushed by vehicle tires and entrained into the air by trailing vehicle wakes.

Maricopa County Department of Transportation (MCDOT) recently completed an evaluation of several unpaved road shoulder control measures.* These measures were examined over a range of road classifications (i.e., local, collector, and arterial), and over a range of average daily traffic (ADT) levels. The analysis separately evaluated reductions to truck bow wake emissions and paved road re-entrained soil emissions from several applicable control measures, including dust palliative stabilization, gravel application, and paving.

The Serious Area PM_{10} Plan included several measures to reduce paved road fugitive dust emissions, including, curbing, paving, and stabilizing unpaved shoulders on paved roads. Maricopa County included an estimate of the benefits of these measures in the 13,783 tons of PM_{10} that paved roads emitted in the nonattainment area in 2005. The reduction attributed to these measures in paved road emissions was estimated to be 4%. This measure would make additional commitments, beyond those established in the Serious Area PM_{10} Plan, to pave and stabilize the unpaved shoulders of additional miles of paved roads located within the nonattainment area.

Suggested Implementing Agency

This measure could be implemented by cities, towns, Maricopa County, and Arizona Department of Transportation.

Cost

The reader is referred to the above-referenced MCDOT report for information on the range of control measures assumed. Information here is limited to the most cost-effective

* Cost Effectiveness of Selected PM_{10} Control Measures, Report No. SR2006-07-01, prepared for the Maricopa County Department of Transportation by Sierra Research, Inc. June 30, 2006.

measure presented in that analysis (measure 21b).* The cost of 8-foot paved shoulders, with a useful life of 20 years, is $25,104 per centerline mile year.

Emission Reduction

The selection of 8-foot paved shoulders is estimated to reduce fugitive dust emissions by 2,721 lbs per centerline mile year, or 1.36 tons per centerline mile year.

Cost Effectiveness

The overall cost effectiveness is $9.23/lb of PM_{10} reduced, or $18,452/ton.

Implementation Issues/Comments

Research on bow wake emissions is limited and no study of control effectiveness for shoulder paving on bow wake emissions could be identified. Therefore, an estimate was prepared based on engineering judgment. Care should be exercised in relying on the benefits computed for this measure.

* A decision was made not to reference the information for curb and gutter due to the high capital cost and the marginal increase in cost effectiveness relative to the 8-foot paved shoulder measure.

37. PAVE OR STABILIZE UNPAVED ACCESS TO PAVED ROADS

PM_{10} emissions are produced indirectly by soil tracked out of construction or industrial sites onto paved, publicly maintained roads. Maricopa County estimates that paved roads produced 13,783 tons or 15% of the PM_{10} emitted annually within the nonattainment area in 2005. Research supported by MAG has confirmed that trackout is a significant source of fugitive dust within the Salt River Basin and that its contribution to monitored values could be higher than suggested by the inventory estimates.

Currently, MCAQD Rule 310 requires trackout or spillage that exceeds 50 feet in length on public roads to be removed immediately. For visible trackout that is less than 50 feet in length, Rule 310 requires removal once per day at the end of working hours. To prevent trackout, owners are currently required to implement one of the following control measures:

- Install either a grizzly or wheel wash system at each access point;
- Install a gravel pad at least 30 feet wide, 50 feet long and 6 inches deep; or
- Pave from the point of access for a centerline distance of 100 feet and width of 20 feet.

Recent analysis of Rule 310 indicates that its effectiveness is on the order of 50% and suggests that there is an opportunity for improvement. This measure would make the trackout requirements of Rule 310 more restrictive by requiring the following:

- Reducing the length that requires rapid cleanup (i.e., 25 feet from any exit);
- Doubling the length of the gravel pad requirements (i.e., 100 ft); and
- Combining gravel pad and grizzly requirements (i.e., 50 ft gravel pad and 24 ft grizzly).

Suggested Implementing Agency

This measure would be implemented by Maricopa County, cities and towns.

Cost

To simplify the calculations, it is also assumed that each facility has only one access point. Costs are presented below for each of the compliance options.

Rapid Cleanup	$2,913 per access point/year
Doubled Gravel Pad	$2,965 per access point/year
Gravel Pad & Grizzly	$4,120 per access point/year

Emission Reduction

The benefit of the control options was estimated by first computing the amount of material that would be dropped by 40 heavy-duty trucks exiting a facility each day. The baseline estimate assumes that the access point is not currently being swept for any of the options.

The baseline for the Rapid Cleanup scenario also assumes that a 100-foot paved apron is in place. The control scenario assumes that the access point is swept every two hours during work hours. The benefit computed for this measure is estimated to be 215 lbs of PM_{10} per access point per year.

The baseline of the Doubled Gravel Pad scenario assumes that the existing gravel pad is 50 feet long. The control scenario assumes that the pad is 100 feet long. The benefit computed for this measure is estimated to be 33 lbs of PM_{10} per access point per year.

The baseline of the Gravel Pad & Grizzly scenario assumes that the existing gravel pad is 50 feet long. The control scenario assumes that the baseline gravel pad is combined with the 24-foot grizzly. The benefit computed for this measure is estimated to be 49 lbs of PM_{10} per access point per year.

Cost Effectiveness

Rapid Cleanup	$16.30/lb or $32,593/ton per access point/year
Doubled Gravel Pad	$89.57/lb or $179,133/ton per access point/year
Gravel Pad & Grizzly	$84.01/lb or $168,025/ton per access point/year

Implementation Issues/Comments

The benefits of this measure are dependent on assumptions about the baseline compliance with Rule 310. This analysis assumed full compliance with Rule 310, which significantly deflates the amount of material that is tracked-out and inflates the cost effectiveness of the measure.

38. STRENGTHEN AND INCREASE ENFORCEMENT OF RULE 310.01 ON VACANT LOTS

There are over 4,000 vacant lots in the Maricopa PM_{10} nonattainment area. To assure compliance with the requirements of Rule 310.01 on these lots will require an increase in the number of Maricopa County Air Quality Department (MCAQD) inspectors and increased trespass prevention actions by lot owners. To evaluate the cost effectiveness of this measure, we assumed that MCAQD would dedicate two inspectors solely to vacant lot inspections, and that owners of non-compliant lots would erect trespass barriers on these lots. We assumed that rock barriers, estimated to have the lowest installed cost for trespass prevention, would be the compliance method selected by more lot owners.

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

Enforcement costs in this analysis include the salary and benefit costs of inspectors, and the costs of processing the Notices of Violation (NOVs) issued by inspectors. We assumed that each inspector would inspect 12 vacant lots per day and issue NOVs to the 32% that are estimated by the MCAQD 2007 rule effectiveness study to be out of compliance. On a per-vacant lot basis, these costs were estimated to total $48.42 per lot per year. The average lot was estimated to be 3.0 acres in size, based on visual examination of a map of vacant lots in the Salt River area published in the Salt River PM_{10} TSD. The cost of erecting a rock boulder barrier around a square lot of this size was estimated to cost $11,400, from survey data also published in the TSD. A rock barrier was assumed to have a useful life of 20 years, which equated to an annualized capital cost of this construction of $1,340 per year. The total cost of this measure was estimated to be $1,390 per year per 3-acre vacant lot.

Emission Reduction

We assumed that the erection of a rock barrier would fully eliminate trespass emissions on a vacant lot. Since this cost effectiveness analysis is being conducted to evaluate control measures effective during winter, stagnant wind conditions, we did not evaluate windblown emissions from vacant lots which would also be reduced as a result of this measure. In the absence of any recorded data, we estimated that the average vacant lot received two trespass trips per week. This infrequent rate compares favorably with the

absence of trespass activity observed by MCAQD inspectors on vacant lots. The emissions from two weekly trips by light-duty vehicles were estimated to produce 11.6 pounds of PM_{10} per year on a 3-acre vacant lot. Windblown emissions are estimated to be 75.8 pounds per year for this lot based on the assumption that the disturbed area is limited to a single 20-foot wide track across the parcel. By eliminating trespass trips, the emission reduction achieved by this measure would be 87.4 pounds of PM_{10} per year per average vacant lot.

Cost Effectiveness

The cost effectiveness of this measure was calculated to be $15.91 per pound, or $31,814 per ton, of PM_{10} reduced.

Implementation Issues/Concerns

This analysis used a very low vehicle trespass rate on vacant lots. If monitoring of trespass activities on vacant lots shows that trespass frequencies are higher, the emission reductions would be greater and the cost effectiveness would also improve.

39. RESTRICT VEHICULAR USE AND PARKING ON VACANT LOTS

This measure is very similar to Measure #38, Strengthen and Increase Enforcement of Rule 310.01 for Vacant Lots. Under this measure, costs are limited to those needed to restrict vehicular access to vacant lots. To evaluate the cost effectiveness of this measure, we assumed that the owner of a vacant would use the lowest cost method available to construct a barrier around a typical lot in order to completely prevent vehicle access. From analyses published in the Salt River PM_{10} SIP prepared by the ADEQ, we assumed that the installation of a rock boulder barrier would be the least expensive method of securing a vacant lot.

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

The cost of installing a rock boulder barrier was estimated to cost $7.90 per linear foot, based on a survey conducted by ADEQ in support of the Salt River SIP. For the purpose of this analysis, we assumed that the average vacant lot covered 3.0 acres. This value was estimated from evaluation of the vacant lot map for the Salt River area published in the Salt River SIP. We assumed that such a lot would be square, and thus have a perimeter of 1,446 linear feet. We estimated that the useful life of a rock boulder barrier would be 20 years, and calculated the annualized cost of this installation at a 3.0-acre square lot to be $1,342 per year.

Emission Reduction

We assumed that the erection of a rock barrier would fully eliminate trespass emissions on a vacant lot. Since this cost effectiveness analysis is being conducted to evaluate control measures effective during winter, stagnant wind conditions, we did not evaluate windblown emissions from vacant lots which would also be reduced as a result of this measure. In the absence of any recorded data, we estimated that the average vacant lot received two trespass trips per week. This infrequent rate compares favorably with the absence of trespass activity observed by MCAQD inspectors on vacant lots. The emissions from two weekly trips by light-duty vehicles were estimated to produce 11.6 pounds of PM_{10} per year on a 3-acre vacant lot. By eliminating trespass trips, the emission reduction achieved by this measure would be 11.6 pounds of PM_{10} per year per

average vacant lot. Windblown emissions are estimated to be 75.8 pounds per year for this lot based on the assumption that the disturbed area is limited to a single 20-foot wide track across the parcel. By eliminating trespass trips, the emission reduction achieved by this measure would be 87.4 pounds of PM_{10} per year per average vacant lot.

Cost Effectiveness

The cost effectiveness of this measure was calculated to be $15.35 per pound, or $30,706 per ton, of PM_{10} reduced.

Implementation Issues/Concerns

This analysis used a very low vehicle trespass frequency on vacant lots. If monitoring of trespass activities on vacant lots shows that trespass frequencies are higher, the emission reductions would be greater and the cost effectiveness of this measure would also improve.

40. ENHANCED ENFORCEMENT OF TRESPASS ORDINANCES AND CODES

Under this measure, trespass violations of Rule 310.01 would be reduced by increased enforcement of rule requirements. Interviews with law enforcement agencies indicated that enforcement would not be practical unless each vacant lot was posted with "no trespassing" signs. We also assumed that enforcement of the measure would not be effective unless law enforcement officers were specifically dedicated to patrolling and issuing tickets to trespass violators. As a result, we assumed that the cost elements of this measure would include the installation of signs on vacant parcels, and the assignment of law enforcement officers solely to enforcement of the trespass requirements of Rule 310.01.

Suggested Implementing Agency

This measure would be implemented by Maricopa County and the cities and towns within the PM_{10} nonattainment area.

Cost

Information on the costs of sign installation and law enforcement costs were obtained from the Maricopa County Department of Transportation (MCDOT) and from the Salt River PM_{10} SIP prepared by the ADEQ. We assumed that "no trespassing" signs would have to be installed every 200 feet along the boundary of a vacant lot in order to withstand legal challenges that trespassers were properly notified of applicable ordinances, and that the cost of sign installation would be $200 per sign. To post the entire perimeter of an average 3-acre parcel, the total cost of sign installation would be $1,456. We assumed that these signs would have a useful life of 15 years, and calculated the annualized cost of this installation to be $191.43 per 3-acre lot. To enforce the "no trespassing" ban, we estimated that two Maricopa County Deputy Sheriffs, or equally compensated police officers, working as a team in one vehicle would be required. The annual cost of these resources was estimated in the Salt River PM_{10} SIP to be $126,945 per year. Distributed over the 4,000 vacant lots within the nonattainment area, this cost would equate to $31.74 per vacant lot. The costs of processing infraction tickets issued by the officers were estimated to cost $1.81 per vacant lot per year. Total costs of sign installation and rule enforcement were calculated from these estimates to be $224.97 per vacant lot per year.

Emission Reduction

We assumed that the installation of signs and enforcement of a trespass prohibition with substantial fines would result in a 75% reduction in direct trespass emissions, not counting any reductions in windblown emissions of disturbed surfaces. Assuming that trespass rates are now on the order of two trips per week per vacant lot, this compliance level would result in estimated emission reductions on a 3-acre vacant lot of 8.72 pounds of PM_{10} per year. Windblown emissions are estimated to be 75.8 pounds per year for this lot based on the assumption that the disturbed area is limited to a single 20-foot wide track across the parcel. Based on the rule effectiveness analysis of Rule 310.01, it is assumed that normal vacant lot inspections will achieve 68% control of windblown emissions. By reducing trespass trips and windblown emissions, the emission reduction achieved by this measure would be 56.52 pounds of PM_{10} per year per average vacant lot.

Cost Effectiveness

The overall cost effectiveness of this measure was calculated to be $3.98 per pound, or $7,961 per ton, of PM_{10} reduced.

Implementation Issues/Concerns

The number of law enforcement personnel needed to enforce the applicable requirements of Rule 310.01 at a 75% compliance level is uncertain. We have assumed in this analysis that the use of two officers in a single vehicle with the authority to issue tickets with substantial penalties would be sufficient to induce compliance if the prohibition and penalty is widely advertised. If a public information campaign is not mounted, then the compliance rate and emission reductions will be lower. This analysis used a very low vehicle trespass frequency on vacant lots. If monitoring of trespass activities on vacant lots shows that trespass frequencies are higher, the emission reductions would be greater and the cost effectiveness of this measure would also improve.

41. VACANT LOTS STABILIZED BY COUNTY IF OWNERS DO NOT RESPOND, LIENS PUT ON PROPERTY IF NECESSARY

This measure is similar to Measure #38, Strengthen and Increase Enforcement of Rule 310.01 for Vacant Lots. Under this measure, the county would install a trespass barrier on any vacant lot when the owner failed to do so, and a lien would be placed against the property to ensure reimbursement to the county. For this analysis, we assumed that an average vacant lot covered 3.0 acres, as estimated from a map of vacant lots in the Salt River area as published in the Salt River PM_{10} SIP prepared by the ADEQ. From this document, we also obtained a cost estimate for rock boulder barriers, which we concluded was the least expensive method of preventing vehicle trespass onto vacant lots.

Suggested Implementing Agency

This measure would be implemented by Maricopa County.

Cost

The cost of installing a rock boulder barrier was estimated to cost $7.90 per linear foot, based on a survey conducted by ADEQ in support of the Salt River SIP. For the purpose of this analysis, we assumed that the average vacant lot covered 3.0 acres and, for the purpose of this analysis, was square with a perimeter of 1,446 linear feet. We estimated that the useful life of a rock boulder barrier would be 20 years, and calculated the annualized cost of this installation on a 3.0-acre square lot to be $1,342 per year. We estimated the cost of recording a lien on a vacant lot to be $177.62, based on county legal salaries and benefits, and that a lien would remain in place for an average of 10 years. The annualized cost of a lien was calculated to be $28.91 per vacant lot per year. The total annual cost of this measure was estimated to be $1,371 per vacant lot per year.

Emission Reduction

We assumed that the erection of a rock barrier would fully eliminate trespass emissions on a vacant lot. Since this cost effectiveness analysis is being conducted to evaluate control measures effective during winter, stagnant wind conditions, we did not evaluate windblown emissions from vacant lots which would also be reduced as a result of this measure. In the absence of any recorded data, we estimated that the average vacant lot received two trespass trips per week. This infrequent rate compares favorably with the absence of trespass activity observed by MCAQD inspectors on vacant lots. The

emissions from two weekly trips by light-duty vehicles were estimated to produce 11.6 pounds of PM_{10} per year on a 3.0-acre vacant lot. By eliminating trespass trips, the emission reductions achieved by this measure would be 11.6 pounds of PM_{10} per year per average vacant lot. Windblown emissions are estimated to be 75.8 pounds per year for this lot based on the assumption that the disturbed area is limited to a single 20-foot wide track across the parcel. By eliminating trespass trips, the emission reduction achieved by this measure would be 87.4 pounds of PM_{10} per year per average vacant lot.

Cost Effectiveness

The cost effectiveness of this measure was calculated to be $15.68 per pound, or $31,367 per ton, of PM_{10} reduced.

Implementation Issues/Concerns

This analysis used a very low vehicle trespass frequency on vacant lots. If monitoring of trespass activities on vacant lots shows that trespass frequencies are higher, the emission reductions would be greater and the cost effectiveness of this measure would also improve.

42. SCHEDULE IMPROVEMENTS ON PARALLEL STREETS TO RETAIN ALTERNATE ROUTE OPTIONS ALONG MAJOR NORTH/SOUTH AND EAST/WEST CORRIDORS

Road improvements typically add capacity to facilitate the efficient flow of traffic. Improvements can include enhancements in signalization and turning capacity, the addition of grade separation, transit turnouts and bike lanes and capacity increases. The addition of improvements along parallel streets provides routing flexibility in times of increased congestion so that speeds do not deteriorate. Fugitive dust on paved roads, tire wear and brake wear are not influenced by vehicle speed. Since this measure does not reduce travel it has no impact on any of those categories of emissions. Vehicle exhaust emissions are influenced by average speed. While speed has a significant impact on hydrocarbons, carbon monoxide and nitrogen oxide emissions, it has a limited impact on exhaust PM_{10} emissions. Sulfate is the only component of exhaust PM_{10} impacted by speed; it however, accounts for less than 10% of exhaust PM_{10} emitted from motor vehicles.

Suggested Implementing Agency

This measure would be implemented by Maricopa County, cities and towns.

Cost

While no estimate of the cost of implementing this measure is available; it should be noted that infrastructure improvements are expensive.

Emission Reduction

Motor vehicles are estimated to have emitted a total of 1,041 tons of PM_{10} in 2005 and account for 1% of the nonattainment inventory. While no estimate of the fraction of travel impacted by this measure is available, it is clear that the impact of this measure on the level of PM_{10} emitted from motor vehicles will be a very small portion of the inventory.

Cost Effectiveness

No estimate of the cost effectiveness of this measure is available.

Implementation Issues/Comments

The potential benefit of this measure is extremely limited and the cost effectiveness per ton of PM_{10} reduced would be very expensive. This measure also has the potential to induce travel which could eliminate any of the PM_{10} reductions.

43. BUILD PARK AND RIDE LOTS EARLIER

According to EPA,* park-and-ride facilities are an important element of all high-occupancy vehicle (HOV) programs. They serve as a collection point for individuals transferring to another vehicle containing at least one other person. Park-and-ride lots generally are designed to serve bus or rail transit, but also can be developed to facilitate carpooling, vanpooling, use of various types of shuttle services, and combinations of these high-occupancy vehicles. Park-and-ride facilities may be dedicated lots on public property or joint-use lots on privately owned property where the normal parking function is not oriented toward modal transfer, such as at shopping centers or churches. The size of park-and-ride facilities varies widely—from only a few spaces in sparsely populated or less heavily travelled corridors to lots of many hundreds of spaces serving major rapid transit lines.

Nearly all major metropolitan areas and many rural areas have implemented some form of park-and-ride program to provide support facilities for transit, congestion relief, or as staging areas for ridesharing. Often, these facilities are developed according to a plan based on predetermined implementation criteria which provides for a systematic program of investment and implementation, also addressing demand for service. On the other hand, some park-and-ride facilities are developed simply as a means of reducing ad hoc parking at particular locations where property may be available.

The 2006 Update of the Regional Transportation Plan (RTP)† has allocated funds to construct park-and-ride facilities in fiscal years 2007 and 2008. This measure calls for constructing these facilities in earlier years.

Suggested Implementing Agency

This measure would be implemented by the Maricopa Association of Governments, Maricopa County and cities and towns.

Cost

According to the 2006 RTP Update funds in the amount of $3 million have been allocated for fiscal year 2007 and for fiscal year 2008 for construction of park-and-ride facilities.

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* *http://www.epa.gov/otaq/stateresources/policy/transp/tcms/park-fringepark.pdf*

† *http://www.mag.maricopa.gov/pdf/cms.resource/2006_RTP_update-final_book95739.pdf*

Emission Reduction

No estimate of the reduction in PM_{10} emissions for the proposed facilities is available. Park-and-ride facilities reduce travel by facilitating the use of transit and carpools. The reduction in travel produces a reduction in both exhaust and fugitive dust emissions. The benefits for this measure, however, would only accrue to the years in which the park-and-ride lots would not have been constructed (which according to the RTP would be years prior to 2007 and 2008). A review of the literature, however, shows that transit buses have PM_{10} drawbacks.

- Transit bus exhaust PM_{10} emissions are almost 100 times higher than PM_{10} emissions from light-duty vehicles (passenger cars and light-duty trucks). This estimate is based on a comparison of vehicle class emission estimates from EPA's mobile source emission factor model MOBILE6.2. The exhaust emissions increase could be diminished or offset through the use of lower sulfur fuel and/or particulate traps.

- An analysis of fugitive dust emissions from transit buses versus light-duty vehicles indicates that a typical bus when fully loaded (i.e., 100% ridership) will reduce PM_{10} emissions by 20% relative to an equivalent number of passenger car trips. The analysis also shows that if the bus ridership drops below 75%, car trips will produce lower levels of PM_{10} than a single bus trip. The problem is that transit buses are significantly heavier than cars and the weight term of the fugitive dust equation for paved roads increases in a nonlinear manner.

If carpools are used instead of transit buses at park-and-ride lots, reductions in both exhaust and fugitive dust emissions will be achieved.

Cost Effectiveness

While no specific estimate of the cost effectiveness of park-and-ride lots is available, the information presented above suggests that the reduction in PM_{10} emissions is likely to be quite limited and the cost effectiveness of that reduction will be extremely expensive.

Implementation Issues/Comments

Transit (including park-and-ride lots) is an extremely expensive form of pollution control. It has high fixed and operational expenses, and if they are fully allocated to reduce emissions, the cost effectiveness is expensive in terms of $/ton reduced. Transit is typically used as an ozone and/or carbon monoxide (CO) control measure, not as a fugitive dust control measure.

44. COORDINATE PUBLIC TRANSIT SERVICES WITH PINAL COUNTY

Public transit is an important component of the regional transportation system. The 2006 Update of the Regional Transportation Plan (RTP)* has allocated about 32% of regional funding to transit related projects. As part of the RTP, a regional bus network is funded; including operating costs, to ensure that reliable service is available on a continuing basis. In addition, light rail corridors are to be constructed to provide a high-capacity backbone for the transit network. Other transit services are included to provide a full range of options, such as paratransit and rural transit service. In addition to the regionally funded elements, local bus services will be funded by individual jurisdictions to supplement regional services.

Discussions with Pinal County staff confirmed that the County has no transit service at this time. Maps presenting planned service improvements in the RTP contain footnotes stating that "Regional transportation facilities in Pinal County are planned by the Central Arizona Association of Governments (CAAG)." Valley Metro and ADOT provide support for the formation and maintenance of carpools in Pinal County.

Suggested Implementing Agency

This measure would be implemented by the Maricopa Association of Governments, Pinal County and CAAG.

Cost

No funds have been allocated for transit in Pinal County therefore it is not possible to determine a cost for the coordination proposed in this measure.

Emission Reduction

No estimate of the reduction in PM_{10} emissions is available for this measure. As noted in the discussion of Measure #43, transit buses have PM_{10} drawbacks.

- Transit bus exhaust PM_{10} emissions are almost 100 times higher than PM_{10} emissions from light-duty vehicles (passenger cars and light-duty trucks). This estimate is based on a comparison of vehicle class emission estimates from EPA's

* *http://www.mag.maricopa.gov/pdf/cms.resource/2006_RTP_update-final_book95739.pdf*

mobile source emission factor model MOBILE6.2. The exhaust emissions increase could be diminished or offset through the use of lower sulfur fuel and/or particulate traps.

- An analysis of fugitive dust emissions from transit buses versus light-duty vehicles indicates that a typical bus when fully loaded (i.e., 100% ridership) will reduce PM_{10} emissions by 20% relative to an equivalent number of passenger car trips. The analysis also shows that if the bus ridership drops below 75%, car trips will produce lower levels of PM_{10} than a single bus trip. The problem is that transit buses are significantly heavier than cars and the weight term of the fugitive dust equation for paved roads increases in a nonlinear manner.

Cost Effectiveness

The information presented above suggests that the reduction in PM_{10} emissions associated with improved transit service is likely to be quite limited and the cost effectiveness of that reduction will be extremely expensive.

Implementation Issues/Comments

Transit (including park-and-ride lots) is an extremely expensive form of pollution control. It has high fixed and operational expenses, and if they are fully allocated to reduce emissions, the cost effectiveness is expensive in terms of $/ton reduced. Transit is typically used as an ozone control measure, not as a fugitive dust control measure.

45. INCREASE FINES FOR OPEN BURNING

The Maricopa County regulates all open outdoor fires.* The purpose of the program is to limit the emissions of air contaminants that are produced from open burning. Any burning of material outdoors (where a flue or chimney is not used) is generally prohibited unless it is one of the following exempt processes:

1. Domestic cooking for immediate human consumption.
2. Warmth for human beings.
3. Recreational purposes, where the burning material is clean, dry wood or charcoal.
4. Branding animals.
5. Orchard heaters for frost protection in farming or nurseries.
6. Disposal of dangerous materials.
7. Fire extinguisher training – limited to small fires in a small container, such as a wastebasket.
8. Testing potentially explosive or flammable products in accordance with the Department of Transportation or Defense guidelines.
9. Testing potentially explosive-containing products for commercial, military, and law enforcement uses.
10. Fire fighting training areas and training structures when the sole source of flame is a burner fueled by LP gas or natural gas.

The penalty for an unpermitted open burn is set in ARS 49-501 Unlawful Open Burning; Definition; Exceptions; Fine.† Any violation is punishable by a fine not to exceed $25. Discussions with Maricopa County inspectors and enforcement staff indicate that the amount of the fine is insufficient to deter the behavior of repeat offenders.

Suggested Implementing Agency

This measure would be implemented by Maricopa County, cities and towns.

Cost

No estimate of the cost of implementing this measure is available.

* *http://www.maricopa.gov/aq/divisions/compliance/dust/open_burning/Default.aspx*
† *http://www.azleg.state.az.us/FormatDocument.asp?inDoc=/ars/49/00501.htm&Title=49&DocType=ARS*

Emission Reduction

The 2005 PM_{10} emission inventory estimates that open burning produces 11.5 tons/year of PM_{10}. This source category represents 0.013% of the inventory for the nonattainment area. This estimate, however, only accounts for emissions from permitted burns; no estimate of the emissions produced by unpermitted burns is included in the inventory. Discussions with Maricopa County indicate that they have no data on the frequency of occurrence of unpermitted open burns. A review of their complaint files indicates that the number of complaints is roughly double the number of permitted burns. Assuming the same amount of material is burned in unpermitted burns and the complaints quantify the extent of the activity, the level of PM_{10} emitted is roughly 23 tons/year and accounts for a very small portion of the inventory.

Cost Effectiveness

No estimate of the cost effectiveness of this measure is available.

Implementation Issues/Comments

Despite the limited emissions benefit of this measure, it is important to note that open burning has been observed in the Salt River on days when the ambient standard has been exceeded. One was observed at the facility located next to the 43rd Avenue monitoring site. Discussions with Maricopa County staff indicate that some facilities in the Salt River area are repeat offenders and are undeterred by $25 fines.

A statute change is required to implement this measure.

46. RESTRICT USE OF OUTDOOR FIREPLACES AND AMBIENCE FIREPLACES IN THE HOSPITALITY INDUSTRY

Wood burning in Maricopa County is governed by a mixture of ordinances and rules. The goal of this measure is to close loopholes within this regulatory structure that allow some wood burning activity to continue on high pollution advisory (HPA) days. ARS 9-500.16* requires cities and towns to adopt, implement and enforce ordinances that prohibit the installation or construction of a fireplace or wood burning stove after 1998 unless it meets clean burning standards (e.g., gas or electric log, EPA certification, etc.). The statute, however, allows flexibility for ordinances to provide exemptions for industrial equipment, cooking devices and outdoor fireplaces.

The Maricopa County Residential Woodburning Restriction Ordinance† restricts residential wood burning in a non-approved device (which is generally pre-1998 stoves, etc.) when monitoring or forecasting indicates that carbon monoxide (CO) and/or particulate standards are likely to be exceeded between October 1st and February 29th. The rule applies to woodburning devices that heat the interior of residences. Barbecue devices, fire pits or mesquite grills are specifically exempted.

Maricopa County Rule 318‡ sets standards for residential woodburning devices that may be exempted from the restrictions established in the Residential Woodburning Restriction Ordinance. Approved woodburning devices include EPA-certified stoves, pellet stoves, gas burning appliances and masonry heaters that meet EPA performance standards. The rule applies to all residences, defined to include single and multiple dwellings, motels, hotels, dormitories, etc. Woodstoves, woodheaters or conventional woodstoves are defined to not include a barbecue device, a cookstove, a boiler or a furnace. It is not clear whether it addresses outdoor fireplaces or pits. Ambience fireplaces in the hospitality industry do appear to be covered.

Suggested Implementing Agency

This measure would be implemented by Maricopa County, cities and towns.

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* *http://www.azleg.state.az.us/FormatDocument.asp?inDoc=/ars/9/00500-16.htm&Title=9&DocType=ARS*

† *http://maricopa.gov/aq/divisions/planning_analysis/rules/docs/rwro9911.pdf*

‡ *http://maricopa.gov/aq/divisions/planning_analysis/rules/docs/318-9904.pdf*

Cost

No estimate of the cost of implementing this measure is available.

Emission Reduction

Emissions from outdoor fireplaces, pits and the hospitality industry are not included in the PM_{10} inventory. Residential woodburning is estimated to produce 231.2 tons/year of PM_{10} emissions in the nonattainment area and account for 0.25% of the inventory. The activities targeted by this measure are expected to represent a fraction of this category of emissions. Therefore, the emission reductions attributed to this measure will be small.

Cost Effectiveness

The Most Stringent Measure Analysis* evaluated two relevant woodburning control measures. The cost effectiveness estimates for the measures are:

- Retrofit existing fireplaces and woodstoves – $190,000/ton of PM_{10} removed; and
- Curtailment of woodheating – $132,000/ton of PM_{10} removed.

Implementation Issues/Comments

Revisions to ARS 9-500.16 and Maricopa County Rules would be required to implement this rule. Current penalties imposed under the Maricopa County Residential Woodburning Restriction Ordinance are $50 for the second violation and $100 for the third and subsequent violations. It is unclear if these fines need to be revised to support the implementation of this measure.

* Most Stringent PM_{10} Control Measure Analysis, prepared for Maricopa Association of Governments by Sierra Research, May 13, 1998.

Analysis of Particulate Control Measure Cost Effectiveness

Appendix

April 18, 2007

MARICOPA ASSOCIATION of GOVERNMENTS

2007 MAG PM-10 Control Measure Summary

No.	Class	Description	Cost-Effectiveness ($/ton PM-10)	Analysis Unit
1	Fugitive Dust Control	Public Education & Outreach With Local Government Assistance	$7,898	Metropolitan Planning Area (per day)
2	Fugitive Dust Control	Extensive Dust Control Training Program	$12,494	50-Acre Construction Project
3	Fugitive Dust Control	Core Dust Control Training Program	$9,986	50-Acre Construction Project
4	Fugitive Dust Control	Dust Managers at Construction Sites of 50+ Disturbed Acres	$14,285	167-Acre Construction Project
5	Fugitive Dust Control	Dedicated Coordinator for Unpaved Road & Vacant Lots	$534	Metropolitan Planning Area (per year)
6	Fugitive Dust Control	Strengthen Stringency & Enforcement of Trackout Provisions	$67,653	Access Point/Yr
7	Fugitive Dust Control	Increase Fines for Dust Control Violations & Publish Violators List	Unknown	Access Point/Yr
8	Fugitive Dust Control	Establish Certification Program for Industry-Standard Dust-Free Developments	$10,752*	Access Point/Yr
9	Fugitive Dust Control	Better Defined Rule 310 Tarping Requirements That Include Bed Enclosure	$16,085	Truck-Operating Day
10	Fugitive Dust Control	Conduct Just-In-Time Grading	Unknown	50-acre project
11	Fugitive Dust Control	Establish Continuous Monitoring Requirements for Permitted Sources Over 50 Acres	$21,530	50-Acre Construction Project
12	Fugitive Dust Control	Conduct Mobile Monitoring to Measure PM-10 and Issue NOVs	$54,233	Property-yr
13	Fugitive Dust Control	Cease Dust Generation Activities During Stagnation Conditions	Unknown	Access Point/Yr
14	Fugitive Dust Control	Establish Maintenance Requirements for Paved Roads & Parking Lots	$320,444	parking lot-yr
15	Fugitive Dust Control	Conduct Nighttime Inspections	$10,752*	Facility-Year
16	Fugitive Dust Control	Increase Inspection Frequency for Permitted Facilities	$65,765	Facility-year
17	Fugitive Dust Control	Increase Number of Proactive Inspections in Areas of Highest PM-10 Emission Densit	$65,899	Facility-year
18	Fugitive Dust Control	Notify Violators More Rapidly to Promote Immediate Compliance	$122,575**	Facility-Year
19	Industry	Fully Implement Rule 316	$32,276**	Facility-Year
20	Industry	Require Private Companies to Use PM-10 Certified Sweepers on Paved Areas (Includ	$320,444	Parking Lot-Year
21	Industry	Shift Hours of Operation During Stagnant Conditions in November-February	Unknown	Access Point/Yr
22	Industry	Model Cumulative Impacts for New or Modified Existing Sources	$141***	Access Point/Yr
23	Industry	Conduct Nighttime and Weekend Inspections	$10,752	50-Acre Project
24	Nonroad Activities	Ban or Discourage Leaf Blower Use on High Pollution Advisory Days	$21,851	Residential Maintenance Day
25	Nonroad Activities	Encourage Use of Leaf Vacuums to Replace Blowers	NA	Vacuum Unit-Operating Day
26	Nonroad Activities	Reduce Off-Road Vehicle Use in High Off-Road Activity Areas (Including Vehicle Impc	$230	Open Space Acre-Yr
27	Nonroad Activities	Create Incentive Fund for Nonroad Diesel Engine Retrofits & Encourage Early Replac	$48,000**	Regionwide
28	Nonroad Activities	Update Statutes to Require Ultra-Low Sulfur Diesel Fuels for Nonroad Equipment	$16,000**	Regionwide
29	Paved Roads	Sweep Streets With PM10-Certified Street Sweepers	$4	centerline mile-yr
30	Paved Roads	Retrofit Onroad Diesel Engines	$120,000**	Regionwide
31	Paved Roads	Repave or Overlay Paved Roads with Rubberized Asphalt	$2,460,441**	centerline mile-yr
32	Unpaved Parking Lots	Pave or Stabilize Existing Unpaved Parking Lots (Including Strengthened Enforcemen	$21,162^	Parking Lot-Year
33	Unpaved Roads	Pave or Stabilize Existing Dirt Roads & Alleys	$141	Metropolitan Planning Area (per year)
34	Unpaved Roads	Limit Speeds to 15 mph on High Traffic Dirt Roads	$899	Road Mile-Year
35	Unpaved Roads	Prohibit New Dirt Roads Including Those Associated With Lot Splits	$2,646	Road mile-year
36	Unpaved Shoulders	Pave or Stabilize Unpaved Shoulders	$18,452	Centerline Mile-Yr
37	Fugitive Dust Control	Pave or Stabilize Unpaved Access to Paved Roads	$168,025^	Access Point/Yr
38	Vacant Lots	Strengthen & Increase Enforcement of Rule 310.01 for Vacant Lots	$31,814	vacant lot-yr
39	Vacant Lots	Restrict Vehicular Use & Parking on Vacant Lots	$30,706	vacant lot-yr
40	Vacant Lots	Enhanced Enforcement of Trespass Ordinances & Codes	$7,961	vacant lot-yr
41	Vacant Lots	Vacant Lots Stabilized by County if Owners Do Not Respond, Including Use of Proper	$31,367	vacant lot-yr
42	Traffic Flow Improvements	Schedule Improvements on Parallel Streets to Retain Alternate Route Options Along I	Unknown	vacant lot-yr
43	Transit	Build Park and Ride Lots Earlier	Unknown	vacant lot-yr
44	Transit	Coordinate Public Transit Services with Pinal County	Unknown	vacant lot-yr
45	Woodburning	Increase Fines for Open Burning (Currently $25)	Unknown	unpermitted burn
46	Woodburning	Restrict Use of Outdoor Fireplaces & Pits and Ambience Fireplaces in Hospitality Indu	$161,000^	outdoor fireplace

* Cost and benefits are based increasing rule effectiveness from 50% to 80% as calculated in measure #23.

** See report for description of cost/benefit calculations.

*** Unpaved road dust palliative treatment was identified as the most cost effective control available to a new facility proponent

^ For measures with multiple cost effectiveness estimates, the mid point was chosen for display.

Public Education & Outreach With Local Government Assistance

Number: 1
Class: Fugitive Dust Control

Analysis Unit: Metropolitan Planning Area (per day)

Total Cost:	**$2,808 per day**
PM10 Reductions (lb):	**711 per day**
PM10 Reductions (tons):	**0.36 per day**
C/E Ratio ($/lb):	**$3.95**
C/E Ratio ($/ton):	**$7,898**

Data from Sacramento 2006 Spare the Air Evaluation/ Communications Office:

2006 Ozone Season Budget =	$584,000	
Days in Ozone Season =	184	
% Purposeful Trip Reducers (of drivers) =	1.80%	Average over 7 years
Mean No. of Daily Trips Avoided/Driver =	2.8	
Total number of drivers in Sacramento NA =	1,392,467	
Total 2005 Sac NA VMT =	48,408,524	from Sac Regional NA 8-Hr Ozone Rate of Progress Report (Feb. 2006)
Estimated 2005 Households =	505,500	based on U.S. Census 2000 data projected to 2005 using population
Program Cost per Household ($/day) =	$0.006	
Average Vehicle Trip Length (miles) =	9.87	U.S. DOT 2001 NHTS Summary of Travel Trends
Estimated Total VMT/day reduced in Sac NA =	692,680	1.43% **Sacramento VMT reduction**

Maricopa County Emission Benefits (County VMT and PM10 EFs from draft 2005 Periodic Emission Inventory for PM10, 1/23/07):

Maricopa County 2005 PM10 Nonattain Area VMT =	78,309,918	
Maricopa County 2005 PM10 Modeling Area VMT =	77,782,356	
Program Cost for Maricopa County/Day =	$2,808	
Estimated 2005 Households =	1,340,638	
Program Cost per Household ($/day) =	$0.002	0.48% **Maricopa Cty VMT reduction**

Paved/ Unpaved	Facility Type	Emission Type	PM10 EF (g/mi)	2005 VMT*	VMT Reduction**	PM10 Reduced (tpd)
Paved	Low ADT Arterials	Fugitive Dust	1.54	9,753,913	46,562	0.079
Paved	High ADT Arterials	Fugitive Dust	0.58	40,436,768	193,033	0.123
Paved	Freeways	Fugitive Dust	0.15	28,119,237	134,233	0.022
Unpaved	High Traffic	Fugitive Dust	666.62	26,916	128	0.094
Unpaved	Low Traffic	Fugitive Dust	666.62	4,517	22	0.016
All	Total All Facilities	Fugitive Dust		78,341,351	373,979	0.335
All	Total All Facilities	Exhaust/Tire-Brake [1]	0.050	78,309,918	373,979	0.021
All	Total All Facilities	All				0.356

* VMT in PM10 Nonattainment Area adjusted from the PM10 Modeling Area for paved and unpaved roads.
Sum of VMT for paved and unpaved roads are higher than estimated total Nonattainment Area VMT in report.

Cost Effectiveness:

Total Cost ($/day) =	$2,808
Total PM10 Reduction (tons/day) =	0.356
Total PM10 Reduction (lb/day) =	711.1
Cost Effectiveness Ratio ($/ton) =	$7,898
Cost Effectiveness Ratio ($/lb) =	$3.95

Extensive Dust Control Training Program

Number: 2
Class: Fugitive Dust Control

Analysis Unit: 50-Acre Construction Project

Total Cost:	**$111,670**
PM10 Reductions (lb):	**17,875**
PM10 Reductions (tons):	**8.94**
C/E Ratio ($/lb):	**$6.25**
C/E Ratio ($/ton):	**$12,494**

Construction/Operational Cost:

Training Cost		
Project Size =	50	acres (assumed)
Residential Project Duration =	6	months (Section 7.7, CARB Area Source Methodologies, August 1997)
Dust Control Class Duration =	4	hr (Section 94 handbook, Clark County Department of Comprehensive Planning, January 2001)
Class Travel Time =	2	hr (estimated)
Total Class Time =	6	hr
Construction Foreman Compensation Rate =	$30.68	/hr (Bureau of Labor Statistics, USDL - Phoenix AZ)
Number of Trained Foremen Per Site =	4	/50-acre project (Clark County Dust Control Program, 1/07)
Training Cost =	$736.37	total
Useful Life of Training =	3	yr (Section 94 handbook, Clark County Department of Comprehensive Planning, January 2001)
Capital Recovery Factor =	0.402	
Annualized Training Cost =	$296.10	/yr
Training Cost Per Project =	$148.05	/50-acre project
Additional Watering Cost		
Baseline Watering Control Efficiency =	50%	(assumed from MCAQD rule effectiveness study)
Baseline Watering Interval =	4.0	hr (Particulate Emission Measurements from Controlled Construction Activities, MRI, April 2001, test series 701)
Fraction of Construction Site Under Active Distrubance =	30%	(estimated)
=	15.0	acres
Surface Coverage Rate =	2.9	acre/hr (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
Water Application Rate =	629	gal/acre (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
Number of Watering Passes =	2.5	passes/10 hr day
Baseline Watering Duration =	12.8	hr/10 hr day
Water Application Rate =	77,996	gal/day
Number of Truck Fillings =	10	fillings/day
Travel and Filling Time =	5.0	hr/day
Baseline Truck Use Time =	17.8	hr/day

Assume that one additional water truck is used onsite in the controlled scenario.

Additional Truck Use Time =	10.0	hr/day
Project Construction Days =	133	day/50 acre project
Water Truck Rental Rate =	$ 62.75	/hr (Empire Southwest, 1/29/07)
Equipment Operator Rate =	$21.20	/hr (Bureau of Labor Statistics, USDL - Phoenix AZ)
Total Water Truck Rate =	$83.94	/hr
=	$839.41	/day
=	$111,522	/50 acre project
Total Cost =	$111,670	/50 acre project

Baseline Emissions:

Construction Site Area =	50	acres
Construction Emission Factors =	0.11	ton PM10/acre-month - non-earthmoving activities (Section 7.7, CARB Area Source Methodologies, August 1997)
=	0.42	ton PM10/acre-month - earthmoving activities (Section 7.7, CARB Area Source Methodologies, August 1997)
Residential Project Duration =	6	months/project (Section 7.7, CARB Area Source Methodologies, August 1997)
Earthmoving Duration =	0.75	months/project (MAG, May 1998)
Non-Earthmoving Emissions =	28.9	ton PM10/project
Earthmoving Emissions =	15.8	ton PM10/project
Total Uncontrolled Project Emissions =	44.6	ton PM10/project
Fraction of Construction Site Under Active Distrubance =	30%	(estimated)
=	15	acres
Number of Water Trucks		

Operating =	1.5	trucks/site (estimated)
Water Application Rate =	629	gal/acre (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
=	9,435	gal/15 acre disturbed area
Water Truck Capacity =	8,000	gal (assumed)
Surface Coverage Rate =	2.9	acre/hr (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
=	1,824	
=	2,736	gal/hr-truck
Watering Time Per Truckload =	2.9	hr/truckload
Water Truck Filling Time =	0.5	hr/truckload (estimated)
Water Truck Effective Watering Time =	3.4	hr/truckload
Effective Surface Coverage Rate =	2,337	gal/hr-truck
Watering Interval =	4.0	hr
Control Efficiency =	49.9%	(Particulate Emission Measurements from Controlled Construction Activities, MRI, April 2001, test series 701)
Baseline Emissions =	22.3	ton PM10/50 acre project

Controlled Emissions:

Number of Water Trucks Operating =	2.5	trucks/site
Effective Surface Coverage Rate =	3,894	gal/hr - 2.5 trucks
Watering Interval =	2.4	hr
Control Efficiency =	70.0%	(Particulate Emission Measurements from Controllec Construction Activities, MRI, April 2001, test series 701)
Controlled Emissions =	13.4	ton PM10/50 acre project

Emission Reduction:

Emission Reduction =	8.9	ton PM10/50 acre project
=	17,875	lb PM10/50 acre project

Cost-Effectiveness:

Cost-Effectiveness =	$12,494	/ton PM10
=	$6.25	/lb PM10

Core Dust Control Training Program

Number: 3
Class: Fugitive Dust Control

Analysis Unit: 50-Acre Construction Project

Total Cost:	**$55,782**
PM10 Reductions (lb):	**11,172**
PM10 Reductions (tons):	**5.59**
C/E Ratio ($/lb):	**$4.99**
C/E Ratio ($/ton):	**$9,986**

Construction/Operational Cost:

Training Cost

Project Size =	50	acres (assumed)
Residential Project Duration =	6	months (Section 7.7, CARB Area Source Methodologies, August 1997)
Dust Control Class Duration =	4	hr (Section 94 handbook, Clark County Department of Comprehensive Planning, January 2001)
Class Travel Time =	2	hr (estimated)
Total Class Time =	6	hr
Construction Foreman Compensation Rate =	$30.68	/hr (Bureau of Labor Statistics, USDL - Phoenix AZ)
Number of Trained Foremen Per Site =	1	/50-acre project (assumed)
Training Cost =	$184.09	total
Useful Life of Training =	3	yr (Section 94 handbook, Clark County Department of Comprehensive Planning, January 2001)
Capital Recovery Factor =	0.402	
Annualized Training Cost =	$74.03	/yr
Training Cost Per Project =	$37.01	/project

Video and Training Material Cost

Material Preparation Costs =	$ 100,000	(estimated)
Number of Active Construction Sites > 50 Acres =	800	equivalent 50-ac projects (2005 Periodic Emission Inventory for PM10, MCAQD, 1/07)
Training Material Lifespan =	3	yr (estimated)
Training Material Cost Per 50-ac Project =	$ 20.83	/50-ac project

Additional Watering Cost

Baseline Watering Control Efficiency =	50%	(assumed from MCAQD rule effectiveness study)
Baseline Watering Interval =	4.0	hr (Particulate Emission Measurements from Controlled Construction Activities, MRI, April 2001, test series 701)
Fraction of Construction Site Under Active Distrubance =	30%	(estimated)
=	15.0	acres
Surface Coverage Rate =	2.9	acre/hr (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
Water Application Rate =	629	gal/acre (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
Number of Watering Passes =	2.5	passes/10 hr day
Baseline Watering Duration =	12.8	hr/day
Number of Water Trucks =	2	trucks/day
Water Application Rate =	23,399	gal/day
Number of Truck Fillings =	3	fillings/day
Travel and Filling Time =	1.5	hr/day
Baseline Truck Use Time =	7.2	hr/day-truck

Assume that 0.5 additional water trucks are used onsite in the controlled scenario.

Additional Truck Use Time =	5.0	hr/day
Project Construction Days =	133	day/50 acre project
Water Truck Rental Rate =	$62.75	/hr (Empire Southwest, 1/29/07)
Equipment Operator Rate =	$21.20	/hr (Bureau of Labor Statistics, USDL - Phoenix AZ)
Total Water Truck Rate =	$83.94	/hr
=	$419.71	/day
=	$55,761	/50 acre project
Total Cost =	$55,782	/50 acre project

Baseline Emissions:

Construction Site Area =	50	acres
Construction Emission Factors =	0.11	ton PM10/acre-month - non-earthmoving activities (Section 7.7, CARB Area Source Methodologies, August 1997)
=	0.42	ton PM10/acre-month - earthmoving activities (Section 7.7, CARB Area Source Methodologies, August 1997)
Residential Project Duration =	6	months/project (Section 7.7, CARB Area Source Methodologies, August 1997)
Earthmoving Duration =	0.75	months/project (MAG, May 1998)
Non-Earthmoving Emissions =	28.9	ton PM10/project

Earthmoving Emissions =	15.8	ton PM10/project
Total Uncontrolled Project Emissions =	44.6	ton PM10/project
Fraction of Construction Site Under Active Distrubance =	30%	(estimated)
=	15	acres
Number of Water Trucks Operating =	1.5	trucks/site (estimated)
Water Application Rate =	629	gal/acre (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
=	9,435	gal/15 acre disturbed area
Water Truck Capacity =	8,000	gal (assumed)
Surface Coverage Rate =	2.9	acre/hr (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
=	1,824	
=	2,736	gal/hr-truck
Watering Time Per Truckload =	2.9	hr/truckload
Water Truck Filling Time =	0.5	hr/truckload (estimated)
Water Truck Effective Watering Time =	3.4	hr/truckload
Effective Surface Coverage Rate =	2,337	gal/hr-truck
Watering Interval =	4.0	hr
Control Efficiency =	49.9%	(Particulate Emission Measurements from Controlled Construction Activities, MRI, April 2001, test series 701)
Baseline Emissions =	22.3	ton PM10/50 acre project

Controlled Emissions:

Number of Water Trucks Operating =	2.0	trucks/site
Effective Surface Coverage Rate =	3,115	gal/hr - 2.0 trucks
Watering Interval =	3.0	hr
Control Efficiency =	62.4%	(Particulate Emission Measurements from Controlled Construction Activities, MRI, April 2001, test series 701)
Controlled Emissions =	16.8	ton PM10/50 acre project

Emission Reduction:

Emission Reduction =	5.6	ton PM10/50 acre project
=	11,172	lb PM10/50 acre project

Cost-Effectiveness:

Cost-Effectiveness =	$9,986	/ton PM10
=	$4.99	/lb PM10

Dust Managers at Construction Sites of 50+ Disturbed Acres

Number: 4
Class: Fugitive Dust Control

Analysis Unit: 167-Acre Construction Project

Total Cost:	**$381,067**
PM10 Reductions (lb):	**53,354**
PM10 Reductions (tons):	**26.68**
C/E Ratio ($/lb):	**$7.14**
C/E Ratio ($/ton):	**$14,285**

Construction/Operational Cost:

Dust Manager Cost

Project Size =	167	acres (assumed)
Residential Project Duration =	6	months (Section 7.7, CARB Area Source Methodologies, August 1997)
Dust Manager Compensation Rate =	$35.00	/hr (estimated)
Project Construction Hours =	10	hr/day (assumed)
Project Construction Days =	133	day/50 acre project
Dust Manager Cost =	$46,500	/167-acre project)

Additional Watering Cost

Baseline Watering Control Efficiency =	50%	(assumed from MCAQD rule effectiveness study)
Baseline Watering Interval =	4.0	hr (Particulate Emission Measurements from Controlled Construction Activities, MRI, April 2001, test series 701)
Fraction of Construction Site Under Active Distrubance =	30%	(estimated)
=	50.0	acres (Clark Co. threshold for dust manager requirement)
Surface Coverage Rate =	2.9	acre/hr (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
Water Application Rate =	629	gal/acre (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
Number of Watering Passes =	2.5	passes/10 hr day
Baseline Watering Duration =	42.8	hr/10 hr day
Water Application Rate =	259,987	gal/day
Number of Truck Fillings =	33	fillings/day
Travel and Filling Time =	16.5	hr/day
Baseline Truck Use Time =	59.3	hr/day
Number of Water Trucks Required =	5.0	/167-ac project

Assume that 2.5 additional water trucks are used onsite in the controlled scenario (50% increase).

Additional Truck Use Time =	30.0	hr/day
Project Construction Days =	133	day/167-acre project (WRAP Fugitive Dust Handbook, 2006)
Water Truck Rental Rate =	$ 62.75	/hr (Empire Southwest, 1/29/07)
Equipment Operator Rate =	$21.20	/hr (Bureau of Labor Statistics, USDL - Phoenix AZ)
Total Water Truck Rate =	$83.94	/hr
=	$2,518	/day
=	$334,567	/167-ac project
Total Cost =	$381,067	/167-ac project

Baseline Emissions:

Construction Site Area =	167	acres
Construction Emission Factors =	0.11	ton PM10/acre-month - non-earthmoving activities (Section 7.7, CARB Area Source Methodologies, August 1997)
=	0.42	ton PM10/acre-month - earthmoving activities (Section 7.7, CARB Area Source Methodologies, August 1997)
Residential Project Duration =	6	months/project (Section 7.7, CARB Area Source Methodologies, August 1997)
Earthmoving Duration =	0.75	months/project (MAG, May 1998)
Non-Earthmoving Emissions =	96.4	ton PM10/167-ac project
Earthmoving Emissions =	52.6	ton PM10/project
Total Uncontrolled Project Emissions =	149.0	ton PM10/167-ac project
Fraction of Construction Site Under Active Distrubance =	30%	(estimated)
=	50	acres
Number of Water Trucks Operating =	5.0	trucks/site (estimated)
Water Application Rate =	629	gal/acre (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
=	31,513	gal/15 acre disturbed area
Water Truck Capacity =	8,000	gal (assumed)
Surface Coverage Rate =	2.9	acre/hr (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
=	1,824	gal/hr-truck
=	9,121	gal/hr-9 trucks
Watering Time Per Truckload =	4.4	hr/truckload
Water Truck Filling Time =	0.5	hr/truckload (estimated)
Water Truck Effective Watering Time =	4.9	hr/truckload
Effective Surface Coverage Rate =	8,187	gal/hr-truck
Watering Interval =	3.8	hr
Control Efficiency =	52.3%	(Particulate Emission Measurements from Controlled Construction Activities, MRI, April 2001, test series 701)
Baseline Emissions =	71.1	ton PM10/167-ac project

Controlled Emissions:

Number of Water Trucks Operating =	8.0	trucks/site
Effective Surface Coverage Rate =	13,099	gal/hr - 8.0 trucks
Watering Interval =	2.4	hr
Control Efficiency =	70.2%	(Particulate Emission Measurements from Controlled Construction Activities, MRI, April 2001, test series 701)
Controlled Emissions =	44.5	ton PM10/50 acre project

Emission Reduction:

Emission Reduction =	26.7	ton PM10/167-ac project
=	53,354	lb PM10/167-ac project

Cost-Effectiveness:

Cost-Effectiveness =	$14,285	/ton PM10
=	$7.14	/lb PM10

Dedicated Coordinator for Unpaved Road & Vacant Lots

Number: 5
Class: Fugitive Dust Control

Analysis Unit: Metropolitan Planning Area (per year)

Total Cost:	**$84,486**
PM10 Reductions (lb):	**316,193**
PM10 Reductions (tons):	**158.10**
C/E Ratio ($/lb):	**$0.27**
C/E Ratio ($/ton):	**$534**

Treatment/Operational Cost:

Treatment	Cost per Mile	Control Efficiency	Cost Effectiveness ($/lb)	Selected Treatment
Soil Sement	$2,128	58.3%	1.06	
Coherex	$1,261	35.2%	0.63	
Ligno 10	$769	21.9%	0.38	X (because most cost-effective)
Road Oyl	$2,322	39.3%	1.16	

Unpaved Road Type	Road Miles*	Traffic* (veh/day)	Daily VMT
Total Low Traffic Roads	1129.2	4	4,517
Total High Traffic Roads	224.3	120	26,916

* C. Authur, MAG Inventory

Percent of High Traffic Unpaved Roads Stabilized Each Year with Most Cost-Effective Treatment = 10% (assumed)

Annual Treatment Cost = $17,249

Inspection/Enforcement Cost:

Dust Coordinator
Hourly Compensation Rate = $24.09 /hr (J. Crumbaker/MCAQD, 1/23/07)
Annual Compensation Rate = $50,200 /yr

Annualized Vehicle Use Cost = $ 7,037 per year (based on default values from 2004 BLS Consumer Expenditure Survey and excluding loan finance charges)

Annual Cost for Collecting & Analysis of Traffic Counts = $10,000 /yr (estimated)

Total Cost:

Total Annual Cost = $84,486 /yr
= $ 3,767 /mi-yr

Baseline Emissions:

Uncontrolled Emission Factor = 666.62 g/mile (MAG Inventory)

Uncontrolled Emissions on Targeted High Traffic Roads
Before Annual Treatment = 1,443,805 lb/yr

Controlled Emissions:

Treatment Type = Ligno 10
Control Efficiency = 21.9% lb/yr

Controlled Emissions on High Traffic Roads
After Annual Treatment = 1,127,612 lb/yr

Emission Reduction:

Emission Reduction = 316,193 lb/yr
= 158.1 ton/yr
= 7.0 ton/mi-yr

Cost-Effectiveness:

Cost Effectiveness = $0.27 /lb PM-10
$534 /ton PM-10

Strengthen Stringency & Enforcement of Trackout Provisions

Number: 6
Class: Fugitive Dust Control

Analysis Unit: Access Point/Yr

Total Cost:	**$7,267**
PM10 Reductions (lb):	**214.8**
PM10 Reductions (tons):	**0.11**
C/E Ratio ($/lb):	**$33.83**
C/E Ratio ($/ton):	**$67,653**

Construction/Operational Cost:

Sweeping Cost =		$65 /centerline-mile - scheduled contract service K. McMullen, 6/28/06)
=		$33 /lane-mile - scheduled contract service
Length of Trackout =		455 ft (minimum measured in Salt River TSD, ADEQ, 9/05)
Sweeping Frequency =		5 times per day (assumed)
Operating Schedule =		250 day/yr (estimated)
Annual Sweeping and Travel Distance =		108 mi/yr
Total Annual Cost =		$3,501 /yr-access point

Inspection/Enforcement Cost:

Number of Access Points Inspected =		30 /day (estimated)
Daily Inspection Time Per Access Point =		0.27 hr/access point-day
=		66.67 hr/access point-yr
Inspector Labor Rate =		$24.09 /hr
Annual Access Point Inspection Cost =		$1,606 /access point-yr
Annual Number of NOVs Issued =		24 /access point-yr (assumed)
Clerical Processing Time =		2 hr/NOV (estimated)
Clerical Rate =	$	13.89 /hr (Bureau of Labor Statistics, May 2005 MSA Wage Estimates for Phoenix, mean for Office & Admin Support)
Clerical Cost =	$	667 /access point-yr
Supervisor Processing Time =		2 hr/NOV (estimated)
Supervisor Rate =		$31.11 /hr (J. Crumbaker/MCAQD, 1/23/07)
Supervisor Cost =		$1,493 /access point-yr
Total Inspection and Enforcement Cost =		$3,766 /access point-yr

Total Cost:

Total Cost =	$7,267 /access point-yr

Baseline Emissions:

Daily Operating Rate =		10 hr/day (assumed)
Minimum Access Point Traffic Volume =		8 heavy duty truck crossings/hr (assumed)
=		4 heavy duty truck exits/hr
=		80 heavy duty truck crossings/day
=		40 heavy duty truck exits/day
Uncontrolled Deposition to Paved Road =		0.0033 lb/light duty vehicle-exit (Particulate Emission Measurement from Controlled Construction Activities, EPA/600/R-01/031, EPA, April 2001)
	=	0.0008 lb/pickup tire-pass
	=	0.0021 lb/18-wheel heavy duty truck tire (based on tread area and wheel force ratios)
	=	0.0378 lb/18-wheel truck
Control Efficiency of 20 Foot Paved Approach =		42% (MRI, April 2001)
Rule 310 Required Paved Approa		100 ft (Rule 310, Table 17)
Control Efficiency of 100 Foot Paved Approach =		81.4%
Controlled Deposition to Paved Road =		0.0070 lb/18-wheel truck
Deposition to Paved Road Rate =		0.28 lb soil/facility-day
Deposition Fraction Emitted as PM10 =		30% (M. Zeldin email, 10/8/02)
Increase in Street Emission Rate		0.08 lb PM10/facility-day
	=	30.9 lb PM10/facility-yr

Controlled Emissions:

Salt River Traffic Volume =		19,000 vehicles/day (27th Avenue, 2002, 2003 Average Weekday Traffic, MAG,9/04)
	=	4,750 vehicles/lane-day

=	356	average hourly traffic-1 lane, mid-day
Street Surface Deposition Length =	455	ft (minimum measured in Salt River TSD, ADEQ, 9/05)
Street Surface Deposition Width =	12	ft (estimated)
Street Surface Deposition Area =	5,460	ft2
Initial Street Soil Loading =	2.45	gr/ft2 (PM10 Emission Inventory, Engineering-Science, 10/87, p. 2-3, South Central)
=	1.71	g/m2
Average Silt Content =	5%	(PM10 Emission Inventory, Engineering-Science, 10/87, p. 2-3, South Central)
Initial Street Silt Loading =	0.09	g/m2
Average Vehicle Weight =	3.0	ton/vehicle-avg.
Initial Street Vehicle Emission Factor =	0.0021	lb PM10/VMT (AP-42, 13.2.1-1, 1/95)
Deposition Area Length =	455	ft
=	0.0862	mile
Deposition Area Initial Emission Rate =	0.0633	lb PM10/hr, mid-day
Deposition Area Background Deposition Rate =	0.2109	lb soil/hr, mid-day
Maximum Emission Rate Increase From Facility Deposition =	0.0085	lb PM10/hr, mid-day
Maximum Cumulative Deposition Area Emission Rate =	0.0717	lb PM10/hr, mid-day
=	0.0023	lb PM10/VMT, mid-day
Equilibrium Silt Loading =	0.1036	g/m2 (AP-42. 13.2.1-1, 1/95)
=	0.000021	lb/ft2
Equilibrium Soil Loading =	0.0004	lb/ft2
Equilibrium Deposition Area Soil Load =	2.32	lb/deposition area
Initial Deposition Area Soil Load =	2.45	gr/ft2
	1.91	lb/deposition area
Deposition Area Soil Load Increase from Facility Traffic =	0.41	lb/deposition area
Soil Transfer Rate from Facility to Deposition Area =	0.028	lb/hr
Time to Reach Equilibrium =	14.43	hr

Control effectiveness will be optimized if the interval between sweepings is kept shorter than the time to reach equilibrium street soil loading conditions.

Interval Between Sweepings =	2.0	hr (assumed)
Number of Sweepings Per Day =	5	sweepings/day

Sweep 1	Initial Soil Load	Bckgnd Deposition	Track-out Soil Deposition	Area PM10 Emission Rate	Non-PM10 Soil Loss	Final Soil Load
Hour	(lb/area)	(lb/area)	(lb/area)	(lb/area)	(lb/area)	(lb/area)
1	1.9110	0.2109	0.0282	0.0633	0.2109	1.9392
2	1.9392	0.2109	0.0282	0.0639	0.2129	1.9654

Pre-Sweeping Area Soil Load =	1.9654	lb/deposition area
Reduction in Street Soil Loading From Sweeping =	86%	(estimated from sweeper test data)
Post-Sweeping Area Soil Load =	0.2752	lb/deposition area

Sweep 2	Initial Soil Load	Bckgnd Deposition	Track-out Soil Deposition	Area PM10 Emission Rate	Non-PM10 Soil Loss	Final Soil Load
Hour	(lb/area)	(lb/area)	(lb/area)	(lb/area)	(lb/area)	(lb/area)
3	0.2752	0.2109	0.0282	0.0180	0.0598	0.4544
4	0.4544	0.2109	0.0282	0.0249	0.0829	0.6106

Pre-Sweeping Area Soil Load =	0.6106	lb/deposition area
Reduction in Street Soil Loading From Sweeping =	86%	(estimated from sweeper test data)
Post-Sweeping Area Soil Load =	0.0855	lb/deposition area

Sweep 3	Initial Soil Load	Bckgnd Deposition	Track-out Soil Deposition	Area PM10 Emission Rate	Non-PM10 Soil Loss	Final Soil Load
Hour	(lb/area)	(lb/area)	(lb/area)	(lb/area)	(lb/area)	(lb/area)
5	0.0855	0.2109	0.0282	0.0084	0.0280	0.2966
6	0.2966	0.2109	0.0282	0.0188	0.0628	0.4728

Pre-Sweeping Area Soil Load =	0.4728	lb/deposition area
Reduction in Street Soil Loading From Sweeping =	86%	(estimated from sweeper test data)
Post-Sweeping Area Soil Load =	0.0662	lb/deposition area

Sweep 4	Initial Soil Load	Bckgnd Deposition	Track-out Soil Deposition	Area PM10 Emission Rate	Non-PM10 Soil Loss	Final Soil Load
Hour	(lb/area)	(lb/area)	(lb/area)	(lb/area)	(lb/area)	(lb/area)
7	0.0662	0.2109	0.0282	0.0071	0.0237	0.2816
8	0.2816	0.2109	0.0282	0.0182	0.0607	0.4599

Pre-Sweeping Area Soil Load =	0.4599	lb/deposition area
Reduction in Street Soil Loading From Sweeping =	86%	(estimated from sweeper test data)
Post-Sweeping Area Soil Load =	0.0644	lb/deposition area

Sweep 5	Initial Soil Load	Bckgnd Deposition	Track-out Soil Deposition	Area PM10 Emission Rate	Non-PM10 Soil Loss	Final Soil Load
Hour	(lb/area)	(lb/area)	(lb/area)	(lb/area)	(lb/area)	(lb/area)
9	0.0644	0.2109	0.0282	0.0070	0.0233	0.2802
10	0.2802	0.2109	0.0282	0.0182	0.0605	0.4587

Pre-Sweeping Area Soil Load = 0.4587 lb/deposition area
Reduction in Street Soil Loading
From Sweeping = 86% (estimated from sweeper test data)
Post-Sweeping Area Soil Load = 0.0642 lb/deposition area

Hour	Initial Soil Load (lb/area)	Bckgnd Deposition (lb/area)	Track-out Soil Deposition (lb/area)	Area PM10 Emission Rate (lb/area)	Non-PM10 Soil Loss (lb/area)	Final Soil Load (lb/area)
11	0.0642	0.2109	0.0000	0.0070	0.0232	0.2519
12	0.2519	0.2109	0.0000	0.0169	0.0565	0.4063
13	0.4063	0.2109	0.0000	0.0231	0.0771	0.5401
14	0.5401	0.2109	0.0000	0.0278	0.0928	0.6582
15	0.6582	0.2109	0.0000	0.0316	0.1055	0.7636
16	0.7636	0.2109	0.0000	0.0349	0.1162	0.8583
17	0.8583	0.2109	0.0000	0.0376	0.1253	0.9439
18	0.9439	0.2109	0.0000	0.0400	0.1333	1.0214
19	1.0214	0.2109	0.0000	0.0421	0.1404	1.0920
20	1.0920	0.2109	0.0000	0.0440	0.1466	1.1563
21	1.1563	0.2109	0.0000	0.0456	0.1521	1.2150
22	1.2150	0.2109	0.0000	0.0471	0.1571	1.2688
23	1.2688	0.2109	0.0000	0.0485	0.1616	1.3181
24	1.3181	0.2109	0.0000	0.0497	0.1657	1.3633

Controlled 24-Hour Emission Rat 0.7437 lb PM10/area-day
Uncontrolled 24-Hour Emission R 1.6030 lb PM10/area-day

Emission Reduction:

Emission Reduction = 0.8593 lb PM10/facility-operating day
215 lb PM10/facility-yr

Cost-Effectiveness:

Cost-Effectiveness = $33.83 /lb PM10
= $67,653 /ton PM10

Increase Fines for Dust Control Violations & Publish Violators List

Number: 7
Class: Fugitive Dust Control

Analysis Unit: Access Point/Yr

Total Cost:	**$0**
PM10 Reductions (lb):	**0.0**
PM10 Reductions (tons):	**0.00**
C/E Ratio ($/lb):	**#DIV/0!**
C/E Ratio ($/ton):	**#DIV/0!**

Establish Certification Program for Industry-Standard Dust-Free Developments

Number: 8
Class: Fugitive Dust Control

Analysis Unit: Access Point/Yr

Total Cost:	**$0**
PM10 Reductions (lb):	**0.0**
PM10 Reductions (tons):	**0.00**
C/E Ratio ($/lb):	**#DIV/0!**
C/E Ratio ($/ton):	**#DIV/0!**

Note: Cost and benefits are based increasing rule effectiveness from 50% to 80% as calculated in measure #23.

Better Defined Rule 310 Tarping Requirements That Include Bed Enclosure

Number: 9
Class: Fugitive Dust Control

Analysis Unit: Truck-Operating Day

Total Cost:	**$13.42**
PM10 Reductions (lb):	**1.67**
PM10 Reductions (tons):	**0.0008**
C/E Ratio ($/lb):	**$8.04**
C/E Ratio ($/ton):	**$16,085**

Construction/Operational Cost:

New Tarp Purchase Cost =	$1,300	(Harp's Tarps, http:/www.harpstarps.com/electricwindupsystems.php, 2/12/07, plus shipping and sales tax)
Installation Cost =	$200	(estimated)
Total Installed Cost =	$1,500	/truck
Useful Life =	10	yr (estimated)
Capital Recovery Factor =	0.163	
Annualized Capital Cost =	$244.12	/truck-yr
=	$0.94	/truck-operating day
Operation Time =	1	min/haul cycle (estimated)
Haul Cycle Time =	45	min. (assumed)
Work Day Duration =	10	hr/day (estimated)
Haul Cycle Frequency =	13	cycles/day
Daily Operation Time =	13	min/day
Equipment Operator Rate =	$ 21.20	/hr (Bureau of Labor Statistics, USDL - Phoenix AZ)
Haul Truck Rate =	$ 35.00	/hr (estimated)
Total Operation Cost =	$12.49	/truck-operating day
Total Cost =	$13.42	/truck-operating day

Baseline Emissions:

Loaded Truck Emission Factor =	23.9	gm PM10/VMT (PM10 Control Mgt. Study, HLA, 6/94)
Empty Truck Emission Factor=	4.8	gm PM10/VMT (estimated)
=	0.0105	lb PM10/VMT
Average Daily Mileage =	160	VMT/day (Construction Control Plan Analysis, HLA, 6/94)
Baseline Emission Rate =	1.69	lb PM10/truck-operating day

Controlled Emissions:

Control Efficiency =	99.0%	(PM10 Control Mgt. Study, HLA, 6/94)
Emission Factor =	0.0001	lb PM10/VMT
Average Daily Mileage =	160	VMT/day (Construction Control Plan Analysis, HLA, 6/94)
Controlled Emission Rate =	0.02	lb PM10/truck-operating day

Emission Reductions:

Emission Reduction =	1.67	lb PM10/truck-operating day

Cost-Effectiveness:

Cost-Effectiveness =	$8.04	/lb PM10

Conduct Just-In-Time Grading

Number: 10
Class: Fugitive Dust Control

Analysis Unit: 50-acre project

Total Cost:	**$0**
PM10 Reductions (lb):	**0.0**
PM10 Reductions (tons):	**0.00**
C/E Ratio ($/lb):	**NA**
C/E Ratio ($/ton):	**NA**

This measure provides benefits only during high wind events and not during winter stagnation periods. Therefore, the cost-effectiveness of the measure was not evaluated.

Establish Continuous Monitoring Requirements for Permitted Sources Over 50 Acres

Number: 11
Class: Fugitive Dust Control

Analysis Unit: 50-Acre Construction Project

Total Cost:	**$166,293**
PM10 Reductions (lb):	**15,448**
PM10 Reductions (tons):	**7.72**
C/E Ratio ($/lb):	**$10.76**
C/E Ratio ($/ton):	**$21,530**

Construction/Operational Cost:

Project Area =	50	acres (assumed)
Residential Project Duration =	6	months (Section 7.7, CARB Area Source Methodologies, August 1997)
Monitoring Cost =	$9,128	/month (S. DeYoung/Calpine C*Power, 11/02 adjusted for time)
=	$54,771	/50 acre project
Additional Watering Cost		
Baseline Watering Control Efficiency =	45%	(assumed from MCAQD rule effectiveness study)
Baseline Watering Interval =	4.4	hr (Particulate Emission Measurements from Controlled Construction Activities, MRI, April 2001, test series 701)
Fraction of Construction Site Under Active Distrubance =	30%	(estimated)
=	15.0	acres
Surface Coverage Rate =	2.9	acre/hr (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
Water Application Rate =	629	gal/acre (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
=	9435	gal/15 acres
Number of Watering Passes =	2.3	passes/10 hr day
Baseline Watering Duration =	11.7	hr/day
Number of Water Trucks =	2	trucks/day
Water Application Rate =	21,272	gal/day
Number of Truck Fillings =	3	fillings/day
Travel and Filling Time =	1.5	hr/day
Baseline Truck Use Time =	6.6	hr/day-truck

Assume that 1.0 additional water trucks are used onsite in the controlled scenario.

Additional Truck Use Time =	10	hr/day
Project Construction Days =	133	day/50 acre project
Water Truck Rental Rate =	$ 62.75	/hr
Equipment Operator Rate =	$21.20	/hr
Total Water Truck Rate =	$83.94	/hr
=	$839.41	/day
=	$111,522	/50 acre project
Total Cost =	$166,293	/50 acre project

Baseline Emissions:

Construction Site Area =	50	acres (assumed)
Construction Emission Factors =	0.11	ton PM10/acre-month - non-earthmoving activities (Section 7.7, CARB Area Source Methodologies, August 1997)
=	0.42	ton PM10/acre-month - earthmoving activities (Section 7.7, CARB Area Source Methodologies, August 1997)
Residential Project Duration =	6	months/project (Section 7.7, CARB Area Source Methodologies, August 1997)
Earthmoving Duration =	0.75	months/project (MAG, May 1998)
Non-Earthmoving Emissions =	28.9	ton PM10/50 acre project
Earthmoving Emissions =	15.8	ton PM10/50 acre project
Total Uncontrolled Project Emissions =	44.6	ton PM10/50 acre project
Rule 310 Rule Effectiveness =	45%	(Rule Effectiveness Study for Maricopa County Rules 310, 310.01, and 316, MCAQD, 1/07)
Baseline Emissions =	20.1	ton PM10/50 acre project

Controlled Emissions:

Number of Water Trucks Operating =	2.3	trucks/site
Effective Surface Coverage Rate =	4,225	gal/hr - 2 trucks
Watering Interval =	2.2	hr
Control Efficiency =	72.3%	(Particulate Emission Measurements from Controlled Construction Activities, MRI, April 2001, test series 701)
Controlled Emissions =	12.4	ton PM10/50 acre project

Emission Reduction:

Emission Reduction =	7.7	ton PM10/50 acre project
=	15,448	lb PM10/50 acre project

Cost-Effectiveness:

Cost-Effectiveness =	$10.76	/lb PM10
=	$21,530	/ton PM10

Conduct Mobile Monitoring to Measure PM-10 and Issue NOVs

Number: 12
Class: Fugitive Dust Control

Analysis Unit: Property-yr

Total Cost:	**$107**
PM10 Reductions (lb):	**3.93**
PM10 Reductions (tons):	**0.002**
C/E Ratio ($/lb):	**$27**
C/E Ratio ($/ton):	**$54,233**

Enforcement Cost:

Mobile Monitoring Van Cost =		$500,000	(J. Crumbaker/MCAQD, 2/5/07)
Useful Life =		8	yr (estimated)
Capital Recovery Factor =		0.187	
Annualized Van Cost =		$93,722	/yr
Monitoring Schedule =		251	day/yr (estimated)
=		6	properties/day (estimated)
Distributed Van Cost =	$	62.30	/property-day
Van Operating Cost =		$4,000	/yr (estimated)
=	$	2.66	/property-day
Van Operator Rate =	$	24.09	/hr (J. Crumbaker/MCAQD, 1/23/07)
=	$	192.68	/day
Van Operator Cost =	$	32.11	/property-day
Number of NOVs Issued =		2	/day (assumed)
Clerical Processing Time =		2	hr/NOV (estimated)
Clerical Rate =	$	13.89	/hr (Bureau of Labor Statistics, May 2005 MSA Wage Estimates for Phoenix, mean for Office & Admin Support)
Clerical Cost =	$	9.26	/day
=	$	1.54	/property-day
Supervisor Processing Time =		2	hr/NOV (estimated)
Supervisor Rate =		$31.11	/hr (J. Crumbaker/MCAQD, 1/23/07)
Supervisor Cost =	$	20.74	/property-day
=	$	3.46	/property-day
Total Inspection and Enforcement Cost =	$	102.08	/property-day

Additional Trackout Removal Cost:

Typical Gravel Bed Construction Cost =		$750	/property-yr (A. Bashor/Clark County, November 2002, adjusted to 2006)
Maintenance Time =		2	man-hr/month (estimated)
=		24	man-hr/yr
Laborer Rate =		$15.26	/hr (Bureau of Labor Statistics, USDL - Phoenix AZ)
Maintenance Cost =		$366	property-/yr
Total Gravel Pad Cost =		$1,116	/property-yr
=		$4.45	/property-day

Total Cost:

Total Cost =	$	106.53	/property-day

Baseline Emissions:

Daily Operating Rate =	10	hr/day (assumed)

Assume that facilities that receive NOVs and undertake trackout control or sweeping are those that do not initially comply with Rule 310 trackout requirements.

Salt River Traffic Volume =	19,000	vehicles/day (27th Avenue, 2002, 2003 Average Weekday Traffic, MAG,9/04)
=	4,750	vehicles/lane-day
=	356	average hourly traffic-1 lane, mid-day
Street Surface Deposition Length=	773	ft (App. K, Salt River PM10 TSD, Arizona DEQ, Sept. 2005)
Street Surface Deposition Width =	12	ft (estimated)
Street Surface Deposition Area =	9,276	ft2
Initial Street Soil Loading =	2.45	gr/ft2 (PM10 Emission Inventory, Engineering-Science, 10/87, p. 2-3, South Central)
=	1.71	g/m2
Average Silt Content =	5%	(PM10 Emission Inventory, Engineering-Science, 10/87, p. 2-3, South Central)
Initial Street Silt Loading =	0.09	g/m2

Initial Soil Loading = 0.0004 lb/ft2
Deposition Area Initial Soil Loading = 3.25 lb/deposition area

Average Vehicle Weight = 3.0 ton/vehicle-avg.
Initial Street Vehicle Emission Factor = 0.0021 lb PM10/VMT (AP-42, 13.2.1-1, 1/95)
Deposition Area Length = 773 ft
= 0.1464 mile
Deposition Area Initial Emission Rate = 0.1075 lb PM10/hr
Deposition Area Initial Soil Removal Rate = 0.3583 lb soil/hr

Average Trackout Area Loading = 3.0 g/m3 (App. D, Salt River PM10 TSD, Arizona DEQ, Sept. 2005)
Average Trackout Area Soil Loading = 60.0 g/m3
= 0.0123 lb/ft2

Deposition Area Soil Loading With Trackout = 114.0 lb/deposition area
Deposition Area Emission Rate With Trackout = 0.0208 lb PM10/VMT (AP-42, 13.2.1-1, 1/95)
= 1.09 lb PM10/hr

Deposition Fraction Emitted as PM10 = 30% (M. Zeldin email, 10/8/02)
Deposition Area Soil Removal Rate With Trackout = 3.62 lb soil/hr

Day	Hour	Initial Soil Load (lb/area)	Bckgnd Deposition (lb/area)	Track-out Soil Deposition (lb/area)	Area PM10 Emission Rate (lb/area)	Non-PM10 Soil Loss (lb/area)	Final Soil Load (lb/area)	
1	1	3.2466	0.3583	3.6204	0.1808	0.4218	6.6227	Workday Start
	2	6.6227	0.3583	3.6204	0.2320	0.5412	9.8282	
	3	9.8282	0.3583	3.6204	0.2754	0.6426	12.8889	
	4	12.8889	0.3583	3.6204	0.3137	0.7319	15.8219	
	5	15.8219	0.3583	3.6204	0.3481	0.8123	18.6401	
	6	18.6401	0.3583	3.6204	0.3796	0.8857	21.3535	
	7	21.3535	0.3583	3.6204	0.4086	0.9534	23.9702	
	8	23.9702	0.3583	3.6204	0.4356	1.0163	26.4970	
	9	26.4970	0.3583	3.6204	0.4608	1.0751	28.9398	
	10	28.9398	0.3583	3.6204	0.4845	1.1304	31.3037	Workday End
	11	31.3037	0.3583	0.0000	0.4724	1.1022	30.0874	
	12	30.0874	0.3583	0.0000	0.4605	1.0744	28.9108	
	13	28.9108	0.3583	0.0000	0.4488	1.0473	27.7730	
	14	27.7730	0.3583	0.0000	0.4374	1.0206	26.6732	
	15	26.6732	0.3583	0.0000	0.4262	0.9945	25.6108	
	16	25.6108	0.3583	0.0000	0.4153	0.9689	24.5849	
	17	24.5849	0.3583	0.0000	0.4045	0.9439	23.5948	
	18	23.5948	0.3583	0.0000	0.3940	0.9193	22.6397	
	19	22.6397	0.3583	0.0000	0.3837	0.8953	21.7190	
	20	21.7190	0.3583	0.0000	0.3737	0.8719	20.8317	
	21	20.8317	0.3583	0.0000	0.3638	0.8489	19.9772	
	22	19.9772	0.3583	0.0000	0.3542	0.8265	19.1547	
	23	19.1547	0.3583	0.0000	0.3448	0.8046	18.3635	
	24	18.3635	0.3583	0.0000	0.3357	0.7833	17.6028	
2	25	17.6028	0.3583	3.6204	0.3682	0.8591	20.3542	Workday Start
	26	20.3542	0.3583	3.6204	0.3981	0.9288	23.0061	
	27	23.0061	0.3583	3.6204	0.4257	0.9934	25.5657	
	28	25.5657	0.3583	3.6204	0.4516	1.0537	28.0391	
	29	28.0391	0.3583	3.6204	0.4758	1.1102	30.4318	
	30	30.4318	0.3583	3.6204	0.4986	1.1634	32.7485	
	31	32.7485	0.3583	3.6204	0.5202	1.2138	34.9932	
	32	34.9932	0.3583	3.6204	0.5406	1.2615	37.1698	
	33	37.1698	0.3583	3.6204	0.5601	1.3068	39.2816	
	34	39.2816	0.3583	3.6204	0.5786	1.3501	41.3317	Workday End
	35	41.3317	0.3583	0.0000	0.5649	1.3180	39.8071	
	36	39.8071	0.3583	0.0000	0.5513	1.2865	38.3276	
	37	38.3276	0.3583	0.0000	0.5381	1.2555	36.8923	
	38	36.8923	0.3583	0.0000	0.5250	1.2250	35.5007	
	39	35.5007	0.3583	0.0000	0.5122	1.1950	34.1517	
	40	34.1517	0.3583	0.0000	0.4996	1.1656	32.8449	
	41	32.8449	0.3583	0.0000	0.4872	1.1367	31.5792	
	42	31.5792	0.3583	0.0000	0.4750	1.1084	30.3541	
	43	30.3541	0.3583	0.0000	0.4631	1.0806	29.1688	
	44	29.1688	0.3583	0.0000	0.4514	1.0533	28.0224	
	45	28.0224	0.3583	0.0000	0.4399	1.0265	26.9142	
	46	26.9142	0.3583	0.0000	0.4287	1.0003	25.8436	
	47	25.8436	0.3583	0.0000	0.4177	0.9746	24.8096	
	48	24.8096	0.3583	0.0000	0.4069	0.9494	23.8116	
3	49	23.8116	0.3583	3.6204	0.4340	1.0126	26.3438	Workday Start
	50	26.3438	0.3583	3.6204	0.4593	1.0716	28.7916	
	51	28.7916	0.3583	3.6204	0.4830	1.1271	31.1602	
	52	31.1602	0.3583	3.6204	0.5054	1.1794	33.4541	

	53	33.4541	0.3583	3.6204	0.5267	1.2289	35.6773	
	54	35.6773	0.3583	3.6204	0.5468	1.2758	37.8333	
	55	37.8333	0.3583	3.6204	0.5659	1.3205	39.9256	
	56	39.9256	0.3583	3.6204	0.5842	1.3631	41.9570	
	57	41.9570	0.3583	3.6204	0.6016	1.4037	43.9304	
	58	43.9304	0.3583	3.6204	0.6183	1.4427	45.8481	Workday End
	59	45.8481	0.3583	0.0000	0.6039	1.4091	44.1934	
	60	44.1934	0.3583	0.0000	0.5898	1.3761	42.5858	
	61	42.5858	0.3583	0.0000	0.5758	1.3436	41.0246	
	62	41.0246	0.3583	0.0000	0.5621	1.3117	39.5091	
	63	39.5091	0.3583	0.0000	0.5487	1.2802	38.0384	
	64	38.0384	0.3583	0.0000	0.5354	1.2493	36.6119	
	65	36.6119	0.3583	0.0000	0.5224	1.2190	35.2288	
	66	35.2288	0.3583	0.0000	0.5096	1.1891	33.8883	
	67	33.8883	0.3583	0.0000	0.4971	1.1598	32.5897	
	68	32.5897	0.3583	0.0000	0.4847	1.1310	31.3322	
	69	31.3322	0.3583	0.0000	0.4726	1.1028	30.1151	
	70	30.1151	0.3583	0.0000	0.4607	1.0751	28.9375	
	71	28.9375	0.3583	0.0000	0.4491	1.0479	27.7988	
	72	27.7988	0.3583	0.0000	0.4377	1.0212	26.6982	
4	73	26.6982	0.3583	3.6204	0.4627	1.0797	29.1344	Workday Start
	74	29.1344	0.3583	3.6204	0.4863	1.1347	31.4921	
	75	31.4921	0.3583	3.6204	0.5085	1.1866	33.7756	
	76	33.7756	0.3583	3.6204	0.5296	1.2357	35.9890	
	77	35.9890	0.3583	3.6204	0.5496	1.2823	38.1358	
	78	38.1358	0.3583	3.6204	0.5686	1.3267	40.2192	
	79	40.2192	0.3583	3.6204	0.5867	1.3690	42.2422	
	80	42.2422	0.3583	3.6204	0.6040	1.4094	44.2074	
	81	44.2074	0.3583	3.6204	0.6206	1.4481	46.1174	
	82	46.1174	0.3583	3.6204	0.6365	1.4851	47.9745	Workday End
	83	47.9745	0.3583	0.0000	0.6218	1.4509	46.2600	
	84	46.2600	0.3583	0.0000	0.6074	1.4173	44.5936	
	85	44.5936	0.3583	0.0000	0.5932	1.3841	42.9746	
	86	42.9746	0.3583	0.0000	0.5792	1.3515	41.4021	
	87	41.4021	0.3583	0.0000	0.5655	1.3194	39.8755	
	88	39.8755	0.3583	0.0000	0.5519	1.2879	38.3939	
	89	38.3939	0.3583	0.0000	0.5387	1.2569	36.9567	
	90	36.9567	0.3583	0.0000	0.5256	1.2264	35.5631	
	91	35.5631	0.3583	0.0000	0.5127	1.1964	34.2122	
	92	34.2122	0.3583	0.0000	0.5001	1.1669	32.9034	
	93	32.9034	0.3583	0.0000	0.4877	1.1380	31.6359	
	94	31.6359	0.3583	0.0000	0.4756	1.1097	30.4090	
	95	30.4090	0.3583	0.0000	0.4636	1.0818	29.2218	
	96	29.2218	0.3583	0.0000	0.4519	1.0545	28.0737	
5	97	28.0737	0.3583	3.6204	0.4761	1.1110	30.4653	Workday Start
	98	30.4653	0.3583	3.6204	0.4989	1.1642	32.7809	
	99	32.7809	0.3583	3.6204	0.5205	1.2145	35.0247	
	100	35.0247	0.3583	3.6204	0.5409	1.2621	37.2003	
	101	37.2003	0.3583	3.6204	0.5603	1.3075	39.3112	
	102	39.3112	0.3583	3.6204	0.5789	1.3507	41.3604	
	103	41.3604	0.3583	3.6204	0.5965	1.3919	43.3507	
	104	43.3507	0.3583	3.6204	0.6134	1.4313	45.2847	
	105	45.2847	0.3583	3.6204	0.6296	1.4690	47.1648	
	106	47.1648	0.3583	3.6204	0.6451	1.5052	48.9931	Workday End
	107	48.9931	0.3583	0.0000	0.6303	1.4707	47.2503	
	108	47.2503	0.3583	0.0000	0.6158	1.4368	45.5561	
	109	45.5561	0.3583	0.0000	0.6014	1.4033	43.9096	
	110	43.9096	0.3583	0.0000	0.5873	1.3704	42.3102	
	111	42.3102	0.3583	0.0000	0.5734	1.3380	40.7570	
	112	40.7570	0.3583	0.0000	0.5598	1.3062	39.2494	
	113	39.2494	0.3583	0.0000	0.5464	1.2748	37.7865	
	114	37.7865	0.3583	0.0000	0.5331	1.2440	36.3676	
	115	36.3676	0.3583	0.0000	0.5202	1.2137	34.9920	
	116	34.9920	0.3583	0.0000	0.5074	1.1840	33.6588	
	117	33.6588	0.3583	0.0000	0.4949	1.1548	32.3674	
	118	32.3674	0.3583	0.0000	0.4826	1.1261	31.1170	
	119	31.1170	0.3583	0.0000	0.4705	1.0979	29.9068	
	120	29.9068	0.3583	0.0000	0.4587	1.0703	28.7361	
6	121	28.7361	0.3583	0.0000	0.4471	1.0432	27.6041	
	122	27.6041	0.3583	0.0000	0.4357	1.0166	26.5101	
	123	26.5101	0.3583	0.0000	0.4245	0.9906	25.4532	
	124	25.4532	0.3583	0.0000	0.4136	0.9651	24.4328	
	125	24.4328	0.3583	0.0000	0.4029	0.9401	23.4480	
	126	23.4480	0.3583	0.0000	0.3924	0.9157	22.4982	
	127	22.4982	0.3583	0.0000	0.3822	0.8918	21.5825	
	128	21.5825	0.3583	0.0000	0.3722	0.8684	20.7003	
	129	20.7003	0.3583	0.0000	0.3624	0.8455	19.8507	
	130	19.8507	0.3583	0.0000	0.3528	0.8232	19.0330	
	131	19.0330	0.3583	0.0000	0.3434	0.8014	18.2465	
	132	18.2465	0.3583	0.0000	0.3343	0.7801	17.4903	
	133	17.4903	0.3583	0.0000	0.3254	0.7593	16.7638	
	134	16.7638	0.3583	0.0000	0.3168	0.7391	16.0662	
	135	16.0662	0.3583	0.0000	0.3083	0.7194	15.3968	
	136	15.3968	0.3583	0.0000	0.3001	0.7002	14.7548	
	137	14.7548	0.3583	0.0000	0.2921	0.6815	14.1395	
	138	14.1395	0.3583	0.0000	0.2843	0.6633	13.5502	
	139	13.5502	0.3583	0.0000	0.2767	0.6457	12.9861	

	140	12.9861	0.3583	0.0000	0.2694	0.6285	12.4464
	141	12.4464	0.3583	0.0000	0.2622	0.6119	11.9305
	142	11.9305	0.3583	0.0000	0.2553	0.5958	11.4377
	143	11.4377	0.3583	0.0000	0.2486	0.5801	10.9673
	144	10.9673	0.3583	0.0000	0.2421	0.5650	10.5184
7	145	10.5184	0.3583	0.0000	0.2359	0.5503	10.0905
	146	10.0905	0.3583	0.0000	0.2298	0.5361	9.6829
	147	9.6829	0.3583	0.0000	0.2239	0.5225	9.2948
	148	9.2948	0.3583	0.0000	0.2182	0.5092	8.9256
	149	8.9256	0.3583	0.0000	0.2128	0.4965	8.5746
	150	8.5746	0.3583	0.0000	0.2075	0.4842	8.2411
	151	8.2411	0.3583	0.0000	0.2025	0.4724	7.9246
	152	7.9246	0.3583	0.0000	0.1976	0.4610	7.6243
	153	7.6243	0.3583	0.0000	0.1929	0.4501	7.3396
	154	7.3396	0.3583	0.0000	0.1884	0.4396	7.0699
	155	7.0699	0.3583	0.0000	0.1841	0.4295	6.8146
	156	6.8146	0.3583	0.0000	0.1799	0.4198	6.5731
	157	6.5731	0.3583	0.0000	0.1760	0.4106	6.3448
	158	6.3448	0.3583	0.0000	0.1722	0.4018	6.1291
	159	6.1291	0.3583	0.0000	0.1686	0.3933	5.9256
	160	5.9256	0.3583	0.0000	0.1651	0.3852	5.7335
	161	5.7335	0.3583	0.0000	0.1618	0.3776	5.5524
	162	5.5524	0.3583	0.0000	0.1587	0.3702	5.3818
	163	5.3818	0.3583	0.0000	0.1557	0.3632	5.2212
	164	5.2212	0.3583	0.0000	0.1528	0.3566	5.0700
	165	5.0700	0.3583	0.0000	0.1501	0.3503	4.9279
	166	4.9279	0.3583	0.0000	0.1476	0.3443	4.7943
	167	4.7943	0.3583	0.0000	0.1451	0.3386	4.6689
	168	4.6689	0.3583	0.0000	0.1428	0.3332	4.5511

Baseline Emissions = 10.28 lb PM10/property-day (average of 7 day week)

Controlled Emissions:

50' Gravel Bed Control Efficiency = 46% (Particulate Emission Measurements from Controlled Construction Activities, EPA/600/R-01/031, EPA, April 2001)

Uncontrolled Deposition to Paved Road = 3.2621 lb/hr

Controlled Deposition to Paved Road = 1.7616 lb/hr

Day	Hour	Initial Soil Load (lb/area)	Bckgnd Deposition (lb/area)	Track-out Soil Deposition (lb/area)	Area PM10 Emission Rate (lb/area)	Non-PM10 Soil Loss (lb/area)	Final Soil Load (lb/area)	
1	1	3.2466	0.3583	1.7616	0.1490	0.3477	4.8697	Workday Start
	2	4.8697	0.3583	1.7616	0.1769	0.4128	6.3998	
	3	6.3998	0.3583	1.7616	0.2012	0.4695	7.8489	
	4	7.8489	0.3583	1.7616	0.2229	0.5200	9.2258	
	5	9.2258	0.3583	1.7616	0.2424	0.5656	10.5376	
	6	10.5376	0.3583	1.7616	0.2603	0.6073	11.7899	
	7	11.7899	0.3583	1.7616	0.2767	0.6457	12.9872	
	8	12.9872	0.3583	1.7616	0.2920	0.6813	14.1337	
	9	14.1337	0.3583	1.7616	0.3062	0.7145	15.2328	
	10	15.2328	0.3583	1.7616	0.3195	0.7456	16.2876	Workday End
	11	16.2876	0.3583	0.0000	0.3110	0.7257	15.6092	
	12	15.6092	0.3583	0.0000	0.3027	0.7063	14.9585	
	13	14.9585	0.3583	0.0000	0.2946	0.6875	14.3347	
	14	14.3347	0.3583	0.0000	0.2868	0.6691	13.7370	
	15	13.7370	0.3583	0.0000	0.2791	0.6513	13.1649	
	16	13.1649	0.3583	0.0000	0.2717	0.6340	12.6174	
	17	12.6174	0.3583	0.0000	0.2645	0.6172	12.0940	
	18	12.0940	0.3583	0.0000	0.2575	0.6009	11.5938	
	19	11.5938	0.3583	0.0000	0.2508	0.5851	11.1163	
	20	11.1163	0.3583	0.0000	0.2442	0.5698	10.6605	
	21	10.6605	0.3583	0.0000	0.2378	0.5550	10.2260	
	22	10.2260	0.3583	0.0000	0.2317	0.5407	9.8119	
	23	9.8119	0.3583	0.0000	0.2258	0.5268	9.4176	
	24	9.4176	0.3583	0.0000	0.2200	0.5134	9.0424	
2	25	9.0424	0.3583	1.7616	0.2399	0.5597	10.3627	Workday Start
	26	10.3627	0.3583	1.7616	0.2579	0.6019	11.6227	
	27	11.6227	0.3583	1.7616	0.2746	0.6407	12.8273	
	28	12.8273	0.3583	1.7616	0.2900	0.6766	13.9805	
	29	13.9805	0.3583	1.7616	0.3043	0.7101	15.0859	
	30	15.0859	0.3583	1.7616	0.3178	0.7414	16.1465	
	31	16.1465	0.3583	1.7616	0.3304	0.7708	17.1652	
	32	17.1652	0.3583	1.7616	0.3422	0.7985	18.1443	
	33	18.1443	0.3583	1.7616	0.3534	0.8246	19.0860	
	34	19.0860	0.3583	1.7616	0.3640	0.8494	19.9925	Workday End
	35	19.9925	0.3583	0.0000	0.3544	0.8269	19.1695	
	36	19.1695	0.3583	0.0000	0.3450	0.8050	18.3777	
	37	18.3777	0.3583	0.0000	0.3359	0.7837	17.6164	
	38	17.6164	0.3583	0.0000	0.3269	0.7628	16.8850	

	39	16.8850	0.3583	0.0000	0.3182	0.7425	16.1825	
	40	16.1825	0.3583	0.0000	0.3097	0.7227	15.5084	
	41	15.5084	0.3583	0.0000	0.3015	0.7034	14.8618	
	42	14.8618	0.3583	0.0000	0.2934	0.6846	14.2420	
	43	14.2420	0.3583	0.0000	0.2856	0.6664	13.6483	
	44	13.6483	0.3583	0.0000	0.2780	0.6486	13.0800	
	45	13.0800	0.3583	0.0000	0.2706	0.6314	12.5362	
	46	12.5362	0.3583	0.0000	0.2634	0.6147	12.0164	
	47	12.0164	0.3583	0.0000	0.2565	0.5985	11.5197	
	48	11.5197	0.3583	0.0000	0.2497	0.5827	11.0455	
3	49	11.0455	0.3583	1.7616	0.2670	0.6230	12.2753	Workday Start
	50	12.2753	0.3583	1.7616	0.2830	0.6603	13.4518	
	51	13.4518	0.3583	1.7616	0.2978	0.6949	14.5790	
	52	14.5790	0.3583	1.7616	0.3116	0.7272	15.6600	
	53	15.6600	0.3583	1.7616	0.3246	0.7574	16.6978	
	54	16.6978	0.3583	1.7616	0.3368	0.7859	17.6949	
	55	17.6949	0.3583	1.7616	0.3483	0.8127	18.6538	
	56	18.6538	0.3583	1.7616	0.3592	0.8381	19.5764	
	57	19.5764	0.3583	1.7616	0.3695	0.8621	20.4647	
	58	20.4647	0.3583	1.7616	0.3792	0.8848	21.3204	Workday End
	59	21.3204	0.3583	0.0000	0.3693	0.8616	20.4478	
	60	20.4478	0.3583	0.0000	0.3595	0.8389	19.6077	
	61	19.6077	0.3583	0.0000	0.3500	0.8167	18.7992	
	62	18.7992	0.3583	0.0000	0.3407	0.7951	18.0216	
	63	18.0216	0.3583	0.0000	0.3317	0.7740	17.2743	
	64	17.2743	0.3583	0.0000	0.3229	0.7533	16.5563	
	65	16.5563	0.3583	0.0000	0.3143	0.7333	15.8671	
	66	15.8671	0.3583	0.0000	0.3059	0.7137	15.2058	
	67	15.2058	0.3583	0.0000	0.2977	0.6947	14.5717	
	68	14.5717	0.3583	0.0000	0.2898	0.6761	13.9641	
	69	13.9641	0.3583	0.0000	0.2820	0.6581	13.3822	
	70	13.3822	0.3583	0.0000	0.2745	0.6406	12.8253	
	71	12.8253	0.3583	0.0000	0.2673	0.6236	12.2927	
	72	12.2927	0.3583	0.0000	0.2602	0.6071	11.7837	
4	73	11.7837	0.3583	1.7616	0.2767	0.6455	12.9813	Workday Start
	74	12.9813	0.3583	1.7616	0.2919	0.6812	14.1281	
	75	14.1281	0.3583	1.7616	0.3061	0.7143	15.2274	
	76	15.2274	0.3583	1.7616	0.3195	0.7454	16.2824	
	77	16.2824	0.3583	1.7616	0.3320	0.7746	17.2957	
	78	17.2957	0.3583	1.7616	0.3437	0.8020	18.2698	
	79	18.2698	0.3583	1.7616	0.3548	0.8280	19.2068	
	80	19.2068	0.3583	1.7616	0.3654	0.8525	20.1088	
	81	20.1088	0.3583	1.7616	0.3753	0.8758	20.9776	
	82	20.9776	0.3583	1.7616	0.3848	0.8979	21.8147	Workday End
	83	21.8147	0.3583	0.0000	0.3747	0.8743	20.9240	
	84	20.9240	0.3583	0.0000	0.3649	0.8513	20.0660	
	85	20.0660	0.3583	0.0000	0.3552	0.8289	19.2402	
	86	19.2402	0.3583	0.0000	0.3458	0.8069	18.4457	
	87	18.4457	0.3583	0.0000	0.3366	0.7855	17.6819	
	88	17.6819	0.3583	0.0000	0.3277	0.7646	16.9478	
	89	16.9478	0.3583	0.0000	0.3190	0.7443	16.2429	
	90	16.2429	0.3583	0.0000	0.3105	0.7244	15.5663	
	91	15.5663	0.3583	0.0000	0.3022	0.7051	14.9173	
	92	14.9173	0.3583	0.0000	0.2941	0.6863	14.2952	
	93	14.2952	0.3583	0.0000	0.2863	0.6680	13.6993	
	94	13.6993	0.3583	0.0000	0.2786	0.6502	13.1287	
	95	13.1287	0.3583	0.0000	0.2712	0.6329	12.5829	
	96	12.5829	0.3583	0.0000	0.2641	0.6161	12.0609	
5	97	12.0609	0.3583	1.7616	0.2802	0.6539	13.2467	Workday Start
	98	13.2467	0.3583	1.7616	0.2952	0.6889	14.3823	
	99	14.3823	0.3583	1.7616	0.3093	0.7216	15.4713	
	100	15.4713	0.3583	1.7616	0.3224	0.7522	16.5166	
	101	16.5166	0.3583	1.7616	0.3347	0.7810	17.5208	
	102	17.5208	0.3583	1.7616	0.3463	0.8081	18.4862	
	103	18.4862	0.3583	1.7616	0.3573	0.8337	19.4151	
	104	19.4151	0.3583	1.7616	0.3677	0.8579	20.3094	
	105	20.3094	0.3583	1.7616	0.3775	0.8809	21.1708	
	106	21.1708	0.3583	1.7616	0.3869	0.9027	22.0010	Workday End
	107	22.0010	0.3583	0.0000	0.3768	0.8791	21.1034	
	108	21.1034	0.3583	0.0000	0.3669	0.8560	20.2389	
	109	20.2389	0.3583	0.0000	0.3572	0.8334	19.4065	
	110	19.4065	0.3583	0.0000	0.3477	0.8114	18.6057	
	111	18.6057	0.3583	0.0000	0.3385	0.7899	17.8356	
	112	17.8356	0.3583	0.0000	0.3295	0.7689	17.0955	
	113	17.0955	0.3583	0.0000	0.3207	0.7484	16.3847	
	114	16.3847	0.3583	0.0000	0.3122	0.7284	15.7024	
	115	15.7024	0.3583	0.0000	0.3039	0.7090	15.0478	
	116	15.0478	0.3583	0.0000	0.2957	0.6901	14.4203	
	117	14.4203	0.3583	0.0000	0.2879	0.6717	13.8191	
	118	13.8191	0.3583	0.0000	0.2802	0.6538	13.2434	
	119	13.2434	0.3583	0.0000	0.2727	0.6364	12.6925	
	120	12.6925	0.3583	0.0000	0.2655	0.6195	12.1658	
6	121	12.1658	0.3583	0.0000	0.2585	0.6032	11.6624	
	122	11.6624	0.3583	0.0000	0.2517	0.5873	11.1817	
	123	11.1817	0.3583	0.0000	0.2451	0.5719	10.7230	
	124	10.7230	0.3583	0.0000	0.2387	0.5570	10.2855	
	125	10.2855	0.3583	0.0000	0.2326	0.5426	9.8686	

	126	9.8686	0.3583	0.0000	0.2266	0.5287	9.4716
	127	9.4716	0.3583	0.0000	0.2208	0.5153	9.0937
	128	9.0937	0.3583	0.0000	0.2153	0.5023	8.7344
	129	8.7344	0.3583	0.0000	0.2099	0.4898	8.3929
	130	8.3929	0.3583	0.0000	0.2048	0.4778	8.0687
	131	8.0687	0.3583	0.0000	0.1998	0.4662	7.7609
	132	7.7609	0.3583	0.0000	0.1950	0.4551	7.4691
	133	7.4691	0.3583	0.0000	0.1904	0.4444	7.1926
	134	7.1926	0.3583	0.0000	0.1860	0.4341	6.9307
	135	6.9307	0.3583	0.0000	0.1818	0.4243	6.6829
	136	6.6829	0.3583	0.0000	0.1778	0.4148	6.4486
	137	6.4486	0.3583	0.0000	0.1739	0.4058	6.2272
	138	6.2272	0.3583	0.0000	0.1702	0.3972	6.0181
	139	6.0181	0.3583	0.0000	0.1667	0.3889	5.8207
	140	5.8207	0.3583	0.0000	0.1633	0.3811	5.6347
	141	5.6347	0.3583	0.0000	0.1601	0.3736	5.4593
	142	5.4593	0.3583	0.0000	0.1570	0.3664	5.2941
	143	5.2941	0.3583	0.0000	0.1541	0.3596	5.1387
	144	5.1387	0.3583	0.0000	0.1514	0.3532	4.9924
7	145	4.9924	0.3583	0.0000	0.1487	0.3470	4.8550
	146	4.8550	0.3583	0.0000	0.1462	0.3412	4.7258
	147	4.7258	0.3583	0.0000	0.1439	0.3357	4.6045
	148	4.6045	0.3583	0.0000	0.1416	0.3305	4.4907
	149	4.4907	0.3583	0.0000	0.1395	0.3255	4.3840
	150	4.3840	0.3583	0.0000	0.1375	0.3208	4.2839
	151	4.2839	0.3583	0.0000	0.1356	0.3164	4.1902
	152	4.1902	0.3583	0.0000	0.1338	0.3123	4.1024
	153	4.1024	0.3583	0.0000	0.1321	0.3083	4.0202
	154	4.0202	0.3583	0.0000	0.1305	0.3046	3.9433
	155	3.9433	0.3583	0.0000	0.1291	0.3011	3.8714
	156	3.8714	0.3583	0.0000	0.1276	0.2978	3.8042
	157	3.8042	0.3583	0.0000	0.1263	0.2948	3.7414
	158	3.7414	0.3583	0.0000	0.1251	0.2919	3.6827
	159	3.6827	0.3583	0.0000	0.1239	0.2891	3.6280
	160	3.6280	0.3583	0.0000	0.1228	0.2866	3.5768
	161	3.5768	0.3583	0.0000	0.1218	0.2842	3.5291
	162	3.5291	0.3583	0.0000	0.1208	0.2819	3.4846
	163	3.4846	0.3583	0.0000	0.1199	0.2798	3.4431
	164	3.4431	0.3583	0.0000	0.1191	0.2779	3.4044
	165	3.4044	0.3583	0.0000	0.1183	0.2760	3.3684
	166	3.3684	0.3583	0.0000	0.1176	0.2743	3.3348
	167	3.3348	0.3583	0.0000	0.1169	0.2727	3.3035
	168	3.3035	0.3583	0.0000	0.1162	0.2712	3.2743

Controlled Emissions = 6.3532 lb PM10/property-day (average of 7 day week)

Emission Reduction:

Emission Reduction = 3.9286 lb PM10/property-day

Cost-Effectiveness:

Cost-Effectiveness = 27.12 /lb PM10 - gravel pad option
$54,233 /ton PM10 - gravel pad option

Cease Dust Generation Activities During Stagnation Conditions

Number: 13
Class: Fugitive Dust Control

Analysis Unit: Access Point/Yr

Total Cost:	$0
PM10 Reductions (lb):	0.0
PM10 Reductions (tons):	0.00
C/E Ratio ($/lb):	#DIV/0!
C/E Ratio ($/ton):	#DIV/0!

Establish Maintenance Requirements for Paved Roads & Parking Lots

Number: 14
Class: Fugitive Dust Control

Analysis Unit: parking lot-yr

Total Cost:	**$871**
PM10 Reductions (lb):	**5.4**
PM10 Reductions (tons):	**0.0027**
C/E Ratio ($/lb):	**$160.22**
C/E Ratio ($/ton):	**$320,444**

Construction/Operational Cost:

Typical Parking Lot Area =	1 acre (estimated)
=	5445 ft of 8' lane
Sweeping Cost =	$65 /centerline-mile (scheduled contract service, K. McMullen, 6/28/06)
=	$33 /lane-mile
Sweeping Frequency =	26 times per year (assumed)
Annual Sweeping Distance =	27 mi/yr
Annual Sweeping Cost =	$871 /parking lot-yr

Baseline Emissions:

Parking Lot Silt Loading =	0.6 g/m3 (= 2 x Salt River street levels, App. K, Proposed Revised PM10 SIP for the Salt River Area, Arizona DEQ, June 2005)
Average Vehicle Weight =	3.0 ton/vehicle-avg.
Parking Lot Travel Emission Factor =	0.0073 lb PM10/VMT (AP-42, 13.2.1-1, 1/95)
Parking Frequency =	100 vehicles/acre-day (2005 Periodic Emissions Inventory for PM10 for the Maricopa County, Arizona, Nonattainment Area, MCAQD, January 2007)
Parking Lot Length =	209 ft (assume square lot)
Parking Cycle Travel Distance =	417 ft
=	0.079 mi
Parking Cycle Emission Factor =	0.000578 lb PM10/parking cycle
Baseline Emissions =	0.0578 lb PM10/parking lot-day

Controlled Emissions:

Reduction in Parking Lot Silt From Sweeping =	86% (estimated from sweeper test data)
Post-Sweeping Silt Loading =	0.08 g/m3
Post-Sweeping Parking Lot Travel Emission Factor =	0.0020 lb PM10/VMT (AP-42, 13.2.1-1, 1/95)
Controlled Emissions =	0.0161 lb PM10/parking lot-day

Emission Reduction:

Assume that a swept parking lot returns to pre-swept conditions in 10 days.

Sweeping Frequency =	14 days (based on 26 sweepings per year)
Total Emissions Between Sweepings =	0.6011 lb PM10/14 days
Uncontrolled Emissions =	0.8097 lb PM10/14 days
Emission Reduction =	0.2086 lb PM10/14 days
=	0.0149 lb PM10/parking lot-day
=	5.44 lb PM10/parking lot-yr

Cost-Effectiveness:

Cost-effectiveness =	$ 160.22 /lb PM10
=	$ 320,444 /ton PM10

Conduct Nighttime Inspections

Number: 15
Class: Fugitive Dust Control

Analysis Unit: Facility-Year

Total Cost:	$0
PM10 Reductions (lb):	0.0
PM10 Reductions (tons):	0.00
C/E Ratio ($/lb):	#DIV/0!
C/E Ratio ($/ton):	#DIV/0!

Note: Cost and benefits are based increasing rule effectiveness from 50% to 80% as calculated in measure #23.

Increase Inspection Frequency for Permitted Facilities

Number: 16
Class: Fugitive Dust Control

Analysis Unit: Facility-year

Total Cost:	**$145,257**
PM10 Reductions (lb):	**4,417.4**
PM10 Reductions (tons):	**2.21**
C/E Ratio ($/lb):	**$32.88**
C/E Ratio ($/ton):	**$65,765**

Inspection/Enforcement Cost:

Number of Inspected Facilities =	26	facililties (Appendix S, Salt River TSD, Arizona DEQ, Sept. 2005)
Number of New Inspectors Dedicated to Facility Inspections =	2	(estimated)
Inspector Labor Rate =	$24.09	/hr (J. Crumbaker/MCAQD, 1/23/07)
=	$64,900	/yr (J. Crumbaker/MCAQD, 1/23/07)
Annual Facility Inspection Cost =	$4,992	/facility-yr
Number of Daily Inspections Conducted =	2	/day-inspector (estimated)
Number of Annual Inspections Conducted =	501	/yr-inspector
=	1,003	/yr total
Vacant Lot Inspection Frequency =	38.6	/yr
Rule 316 Compliance Rate =	54%	(MCAQD rule effectiveness study)
Number of Annual NOVs Issued =	461	/yr total
Facility NOV Frequency =	17.7	/facility-yr
Clerical Processing Time =	2	hr/NOV (estimated)
Clerical Rate =	$13.89	/hr (Maricopa County, 8/13/96)
Clerical Cost =	$493	/facility-yr
Supervisor Processing Time =	1	hr/NOV (estimated)
Supervisor Rate =	$25.96	/hr (Maricopa County, 8/13/96)
Supervisor Cost =	$461	/facility-yr
Total Inspection and Enforcement Cost =	$5,946	/facility-yr

Construction/Operational Cost:

Increased Watering Cost		
Average Haul Distance =	0.78	mi (calculated from values in Baseline Emissions below)
Average Haul Road Width =	40	ft (estimated)
Average Haul Road Area =	165,264	ft2
=	3.79	ac
Water Application Rate =	629	gal/acre (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
=	2,386	gal/typical facility haul roads
Surface Coverage Rate =	2.9	acre/hr (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
=	1,824	gal/hr-water truck
Haul Road Watering Time =	1.31	hr

Assume that haul roads are watered every 2 hours currently, and that roads will be watered every hour under this control measure.

Increased Watering Time =	6.5	hr/day (assuming 10 hr operating day)
Facility Operating Schedule =	254	day/yr
Water Truck Rental Rate =	$ 62.75	/hr (Empire Southwest, 1/29/07)
Equipment Operator Rate =	$21.20	/hr (Bureau of Labor Statistics, USDL - Phoenix AZ)
Total Water Truck Rate =	$83.94	/hr
=	$549.09	/day
=	$139,311	/facility-yr
Total Construction/Operating Cost =	$139,311	/facility-yr

Total Cost:

Total Cost = $145,257 /facility-yr

Baseline Emissions:

Assume that most fugitive PM10 emissions at inspected facilities are generated by haul roads (see App. S, Salt River TSD, Sept. 2005), and that watering is the primary method of control. Assume that facilities will double water application on haul roads as a result of this measure.

Typical Rule 316 Facility
Operating Schedule = 254 day/yr (estimated)

Typical Rule 316 Facility
Throughput = 500,000 ton/yr (Appendix S, Salt River TSD, Arizona DEQ, Sept. 2005)
= 1,971 ton/operating day

Typical Onsite Haul Load = 25 tons (estimated)
Typical Onsite Vehicle Weigth = 32.5 tons (estimated)

Number of Vehicle Passes = 158 vehicle-passes/day
= 15.8 vehicle-passes/hr (assumes 10 hr/day operating schedule)

Emission Factor = (k)[(s/12)^a][(W/3)^b] (Ap-42, 13.2.2-4, eqn. 1a, 11/06)
where:
k = Particle size factor, fraction
s = Silt content, fraction
W = Weight, tons

k = 1.5
s = 11.9% (C. Arthur/MAG, 6/16/06 email)
W = 32.5 (estimated - avg. of loaded and empty on-highway haul truck)

a = 0.9
b = 0.45

Uncontrolled Emission Factor = 4.35 lb PM10/VMT

Assume onsite haul roads are watered evey 4 hours in 2002.

Watering Control Efficiency = 100 - (0.8)(p)(d)(t)/(i) % (Control of Open Fugitive Dust Sources, EPA, 9/88)

where:
p = potential average hourly daytime evaporation rate, mm/hr
d = average hourly daytime traffic rate, vehicle-passes/hr
t = time between watering applications, hr/application
I = water application intensity, L/m2

p = 105 in/yr
= 0.51 mm/yhr
d = 16 vehicle-passes/day
t = 4 hr
I = 1.0 L/m2 (assumed)

Watering Control Efficiency = 74.0% (estimated for 2002)

2002 Emission Factor = 1.13 lb PM10/VMT

2002 Haul Road Emissions = 200,904 lb PM10/yr (App. S, Salt River TSD, Arizona DEQ, Sept. 2005)

2002 Onsite Haul Truck Travel = 177,940 mi

2002 Areawide Throughput = 5,684,987 tons (App. S, Salt River TSD, Arizona DEQ, Sept. 2005)

Onsite Truck Haul Distance = 0.031 mi/ton - 2002

Typical Facility 2002 Haul Road
Emissions = 17,670 lb PM10/yr - 500,000 ton/yr throughput

Assume onsite haul roads are watered evey 2 hours in 2006 and that onsite haul truck travel remains unchanged from 2002.

Watering Control Efficiency = 100 - (0.8)(p)(d)(t)/(i) % (Control of Open Fugitive Dust Sources, EPA, 9/88)

where:
p = potential average hourly daytime evaporation rate, mm/hr
d = average hourly daytime traffic rate, vehicle-passes/hr
t = time between watering applications, hr/application

i = water application intensity, L/m2

p = 105 in/yr
= 0.51 mm/yhr
d = 16 vehicle-passes/day
t = 2 hr
i = 1.0 L/m2 (assumed)

Watering Control Efficiency = 87.0% (estimated for 2006)

Baseline Emission Factor = 0.56 lb PM10/VMT - 2006
= 0.018 lb PM10/ton throughput

Typical Facility Baseline Emissions = 8,835 lb/facility-yr

Controlled Emissions:

Assume onsite haul roads are watered every hour in the future and that onsite haul truck travel remains unchanged from 2002.

Watering Control Efficiency = 100 - (0.8)(p)(d)(t)/(i) % (Control of Open Fugitive Dust Sources, EPA, 9/88)

where:

p = potential average hourly daytime evaporation rate, mm/hr
d = average hourly daytime traffic rate, vehicle-passes/hr
t = time between watering applications, hr/application
i = water application intensity, L/m2

p = 105 in/yr
= 0.51 mm/yhr
d = 16 vehicle-passes/day
t = 1 hr
i = 1.0 L/m2 (assumed)

Watering Control Efficiency = 93.5% (estimated for 2006)

Controlled Emission Factor = 0.28 lb PM10/VMT
= 0.0088 lb PM10/ton throughput

Typical Facility Uncontrolled Emissions = 4,417 lb/facility-yr

Emission Reduction:

Emission Reduction = 4,417 lb/facility-yr

Cost-Effectiveness:

Cost-Effectiveness = $32.88 /lb PM10
= $65,765 /ton PM10

Increase Number of Proactive Inspections in Areas of Highest PM-10 Emission Densities

Number: 17
Class: Fugitive Dust Control

Analysis Unit: Facility-year

Total Cost:	**$145,553**
PM10 Reductions (lb):	**4,417.4**
PM10 Reductions (tons):	**2.21**
C/E Ratio ($/lb):	**$32.95**
C/E Ratio ($/ton):	**$65,899**

Inspection/Enforcement Cost:

Number of Inspected Facilities =	26	facililties (Appendix S, Salt River TSD, Arizona DEQ, Sept. 2005)
Number of New Inspectors Dedicated to Facility Inspections =	2	(estimated)
Inspector Labor Rate =	$24.09	/hr (J. Crumbaker/MCAQD, 1/23/07)
=	$64,900	/yr (J. Crumbaker/MCAQD, 1/23/07)
Annual Facility Inspection Cost =	$4,992	/facility-yr
Number of Daily Inspections Conducted =	2	/day-inspector (estimated)
Number of Annual Inspections Conducted =	501	/yr-inspector
=	1,003	/yr total
Vacant Lot Inspection Frequency =	38.6	/yr
Rule 316 Compliance Rate =	54%	(MCAQD rule effectiveness study)
Number of Annual NOVs Issued =	461	/yr total
Facility NOV Frequency =	17.7	/facility-yr
Clerical Processing Time =	2	hr/NOV (estimated)
Clerical Rate =	$13.89	/hr (Maricopa County, 8/13/96)
Clerical Cost =	$493	/facility-yr
Supervisor Processing Time =	1	hr/NOV (estimated)
Supervisor Rate =	$25.96	/hr (Maricopa County, 8/13/96)
Supervisor Cost =	$461	/facility-yr
Total Inspection and Enforcement Cost =	$5,946	/facility-yr

Construction/Operational Cost:

Training Cost		
Dust Control Class Duration =	4	hr (Section 94 handbook, Clark County Department of Comprehensive Planning, January 2001)
Class Travel Time =	2	hr (estimated)
Total Class Time =	6	hr
Plant Foreman Compensation Rate =	$30.68	/hr
Number of Trained Foremen Per Site =	4	(estimated)
Training Cost =	$736.37	total
Useful Life of Training =	3	yr (Section 94 handbook, Clark County Department of Comprehensive Planning, January 2001)
Capital Recovery Factor =	0.402	
Annualized Training Cost =	$296.10	/facility-yr
Increased Watering Cost		
Average Haul Distance =	0.78	mi (calculated from values in Baseline Emissions below)
Average Haul Road Width =	40	ft (estimated)
Average Haul Road Area =	165,264	ft2
=	3.79	ac
Water Application Rate =	629	gal/acre (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
=	2,386	gal/typical facility haul roads
Surface Coverage Rate =	2.9	acre/hr (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
=	1,824	gal/hr-water truck
Haul Road Watering Time =	1.31	hr

Assume that haul roads are watered every 2 hours currently, and that roads will be watered every hour under this control measure.

Increased Watering Time =	6.5	hr/day (assuming 10 hr operating day)
Facility Operating Schedule =	254	day/yr
Water Truck Rental Rate =	$ 62.75	/hr (Empire Southwest, 1/29/07)
Equipment Operator Rate =	$21.20	/hr (Bureau of Labor Statistics, USDL - Phoenix AZ)
Total Water Truck Rate =	$83.94	/hr
=	$549.09	/day
=	$139,311	/facility-yr
Total Construction/Operating Cost =	$139,607	/facility-yr

Total Cost:

Total Cost =	$145,553	/facility-yr

Baseline Emissions:

Assume that most fugitive PM10 emissions at inspected facilities are generated by haul roads (see App. S, Salt River TSD, Sept. 2005), and that watering is the primary method of control. Assume that facilities will double water application on haul roads as a result of this measure.

Typical Rule 316 Facility Operating Schedule =	254	day/yr (estimated)
Typical Rule 316 Facility Throughput =	500,000	ton/yr (Appendix S, Salt River TSD, Arizona DEQ, Sept. 2005)
=	1,971	ton/operating day
Typical Onsite Haul Load =	25	tons (estimated)
Typical Onsite Vehicle Weigth =	32.5	tons (estimated)
Number of Vehicle Passes =	158	vehicle-passes/day
=	15.8	vehicle-passes/hr (assumes 10 hr/day operating schedule)

Emission Factor = (k)[(s/12)^a][(W/3)^b] (Ap-42, 13.2.2-4, eqn. 1a, 11/06)

where:

k =	Particle size factor, fraction	
s =	Silt content, fraction	
W =	Weight, tons	
k =	1.5	
s =	11.9%	(C. Arthur/MAG, 6/16/06 email)
W =	32.5	(C. Arthur/MAG, 6/16/06 email)
a =	0.9	
b =	0.45	

Uncontrolled Emission Factor = 4.35 lb PM10/VMT

Assume onsite haul roads are watered evey 4 hours in 2002.

Watering Control Efficiency = 100 - (0.8)(p)(d)(t)/(i) % (Control of Open Fugitive Dust Sources, EPA, 9/88)

where:

p = potential average hourly daytime evaporation rate, mm/hr
d = average hourly daytime traffic rate, vehicle-passes/hr
t = time between watering applications, hr/application
I = water application intensity, L/m2

p =	105	in/yr
=	0.51	mm/yhr
d =	16	vehicle-passes/day
t =	4	hr
I =	1.0	L/m2 (assumed)

Watering Control Efficiency = 74.0% (estimated for 2002)

2002 Emission Factor = 1.13 lb PM10/VMT

2002 Haul Road Emissions = 200,904 lb PM10/hr (App. S, Salt River TSD, Arizona DEQ, Sept. 2005)

2002 Onsite Haul Truck Travel = 177,940 mi

2002 Areawide Throughput = 5,684,987 tons (App. S, Salt River TSD, Arizona DEQ, Sept. 2005)

Onsite Truck Haul Distance = 0.031 mi/ton - 2002

Typical Facility 2002 Haul Road Emissions = 17,670 lb PM10/yr - 500,000 ton/yr throughput

Assume onsite haul roads are watered evey 2 hours in 2006 and that onsite haul truck travel remains unchanged from 2002.

Watering Control Efficiency = 100 - (0.8)(p)(d)(t)/(i) % (Control of Open Fugitive Dust Sources, EPA, 9/88)

where:

p = potential average hourly daytime evaporation rate, mm/hr
d = average hourly daytime traffic rate, vehicle-passes/hr
t = time between watering applications, hr/application
I = water application intensity, L/m2

p =	105	in/yr
=	0.51	mm/yhr
d =	16	vehicle-passes/day
t =	2	hr
I =	1.0	L/m2 (assumed)

Watering Control Efficiency = 87.0% (estimated for 2006)

Baseline Emission Factor = 0.56 lb PM10/VMT - 2006
= 0.018 lb PM10/ton throughput

Typical Facility Baseline Emissions = 8,835 lb/facility-yr

Controlled Emissions:

Assume onsite haul roads are watered every hour in the future and that onsite haul truck travel remains unchanged from 2002.

Watering Control Efficiency = 100 - (0.8)(p)(d)(t)/(i) % (Control of Open Fugitive Dust Sources, EPA, 9/88)

where:

p = potential average hourly daytime evaporation rate, mm/hr
d = average hourly daytime traffic rate, vehicle-passes/hr
t = time between watering applications, hr/application
I = water application intensity, L/m2

p =	105	in/yr
=	0.51	mm/yhr
d =	16	vehicle-passes/day
t =	1	hr
I =	1.0	L/m2 (assumed)

Watering Control Efficiency = 93.5% (estimated for 2006)

Controlled Emission Factor = 0.28 lb PM10/VMT
= 0.0088 lb PM10/ton throughput

Typical Facility Uncontrolled Emissions = 4,417 lb/facility-yr

Emission Reduction:

Emission Reduction = 4,417 lb/facility-yr

Cost-Effectiveness:

Cost-Effectiveness = $32.95 /lb PM10
= $65,899 /ton PM10

Notify Violators More Rapidly to Promote Immediate Compliance

Number: 18
Class: Fugitive Dust Control

Analysis Unit: Facility-Year

Total Cost:	$0
PM10 Reductions (lb):	0.0
PM10 Reductions (tons):	0.00
C/E Ratio ($/lb):	#DIV/0!
C/E Ratio ($/ton):	#DIV/0!

Note: See report for description of cost/benefit calculations.

Fully Implement Rule 316

Number: 19
Class: Industry

Analysis Unit: Facility-Year

Total Cost:	$0
PM10 Reductions (lb):	0.0
PM10 Reductions (tons):	0.00
C/E Ratio ($/lb):	#DIV/0!
C/E Ratio ($/ton):	#DIV/0!

Note: See report for description of cost/benefit calculations.

Require Private Companies to Use PM-10 Certified Sweepers on Paved Areas (Including Parking Lots)

Number: 20
Class: Industry

Analysis Unit: Parking Lot-Year

Total Cost:	**$871**
PM10 Reductions (lb):	**5.4**
PM10 Reductions (tons):	**0.0027**
C/E Ratio ($/lb):	**$160.22**
C/E Ratio ($/ton):	**$320,444**

Construction/Operational Cost:

Typical Parking Lot Area =	1	acre (estimated)
=	5445	ft of 8' lane
Sweeping Cost =	$65	/centerline-mile (scheduled contract service, K. McMullen, 6/28/06)
=	$33	/lane-mile
Sweeping Frequency =	26	times per day (assumed)
Operating Schedule =	208	day/yr (D. Kukino, 2/22/06)
Annual Sweeping Distance =	27	mi/yr
Annual Sweeping Cost =	$871	/parking lot-yr

Baseline Emissions:

Parking Lot Silt Loading =	0.6	g/m3 (= 2 x Salt River street levels, App. K, Proposed Revised PM10 SIP for the Salt River Area, Arizona DEQ, June 2005)
Average Vehicle Weight =	3.0	ton/vehicle-avg.
Parking Lot Travel Emission Factor =	0.0073	lb PM10/VMT (AP-42, 13.2.1-1, 1/95)
Parking Frequency =	100	vehicles/acre-day (2005 Periodic Emissions Inventory for PM10 for the Maricopa County, Arizona, Nonattainment Area, MCAQD, January 2007)
Parking Lot Length =	209	ft (assume square lot)
Parking Cycle Travel Distance =	417	ft
=	0.079	mi
Parking Cycle Emission Factor =	0.000578	lb PM10/parking cycle
Baseline Emissions =	0.0578	lb PM10/parking lot-day

Controlled Emissions:

Reduction in Parking Lot Silt From Sweeping =	86%	(estimated from sweeper test data)
Post-Sweeping Silt Loading =	0.08	g/m3
Post-Sweeping Parking Lot Travel Emission Factor =	0.0020	lb PM10/VMT (AP-42, 13.2.1-1, 1/95)
Controlled Emissions =	0.0161	lb PM10/parking lot-day

Emission Reduction:

Assume that a swept parking lot returns to pre-swept conditions in 10 days.

Sweeping Frequency =	14	days (based on 26 sweepings per year)
Total Emissions Between Sweepings =	0.6011	lb PM10/14 days
Uncontrolled Emissions =	0.8097	lb PM10/14 days
Emission Reduction =	0.2086	lb PM10/14 days
=	0.0149	lb PM10/parking lot-day
=	5.44	lb PM10/parking lot-yr

Cost-Effectiveness:

Cost-effectiveness =	$ 160.22	/lb PM10
=	$ 320,444	/ton PM10

Shift Hours of Operation During Stagnant Conditions in November-February

Number: 21
Class: Industry

Analysis Unit: Access Point/Yr

Total Cost:	$0
PM10 Reductions (lb):	0.0
PM10 Reductions (tons):	0.00
C/E Ratio ($/lb):	#DIV/0!
C/E Ratio ($/ton):	#DIV/0!

Model Cumulative Impacts for New or Modified Existing Sources

Number: 22
Class: Industry

Analysis Unit: Access Point/Yr

Total Cost:	$0
PM10 Reductions (lb):	0.0
PM10 Reductions (tons):	0.00
C/E Ratio ($/lb):	#DIV/0!
C/E Ratio ($/ton):	#DIV/0!

Note: Unpaved road dust palliative treatment was identified as the most cost effective control available to a new facility proponent

Conduct Nighttime and Weekend Inspections

Number: 23
Class: Industry

Analysis Unit: 50-Acre Project

Total Cost:	**$54,912**
PM10 Reductions (lb):	**10,214.4**
PM10 Reductions (tons):	**5.11**
C/E Ratio ($/lb):	**$5.38**
C/E Ratio ($/ton):	**$10,752**

Inspection/Enforcement Cost:

Purchase Cost of DustTrak Portable Monitor =	$4,200	(Solutions and Supplies telecon, 2/7/07)
Useful Life =	8	yr (estimated)
Capital Recovery Factor =	0.187	
Annualized Capital Cost =	$787	/yr
Number of Projects Inspected =	200	/yr (estimated)
Project Cost =	$3.94	/50-acre project
Number of Project Inspections =	4	/yr (estimated)
Proejct Inspection Time =	2	hr/50-acre project (estimated)
Annual Project Inspection Time =	8	hr/50-acre project
Inspector Labor Rate =	$24.09	/hr (J. Crumbaker/MCAQD, 1/23/07)
Night Differential Pay Rate =	$0.75	/hr (J. Crumbaker, 1/23/07 email)
Inspector Night Labor Rate =	$24.84	/hr
Project Inspection Cost =	$198.68	/50-acre project
Annual Number of NOVs Issued =	1	/50-acre project (estimated)
Clerical Processing Time =	2	hr/NOV (estimated)
Clerical Rate =	$ 13.89	/hr (Bureau of Labor Statistics, May 2005 MSA Wage Estimates for Phoenix, mean for Office & Admin Support)
Clerical Cost =	$ 27.78	/50-acre project
Supervisor Processing Time =	8	hr/NOV (estimated)
Supervisor Rate =	$31.11	/hr (J. Crumbaker/MCAQD, 1/23/07)
Supervisor Cost =	$248.91	/50-acre project
Total Inspection and Enforcement Cost =	$479.31	/50-acre project

Construction/Operation Cost:

[Assume that night inspections result in two additional water trucks per facility being operated during night hours. Also assume that facility operations commence at 4:00 am during the cooler half of the year and at midnight during the warmer half. Also assume that additional watering is conducted between these startup times and 6:00am when daylight dust controls commence operation.]

Equipment Operator Labor Rate =	$21.20	/hr (Bureau of Labor Statistics, USDL - Phoenix AZ)
Number of Operators Required =	2	/night (estimated)
Total Hours of Night Operation =	521	hr/year
Total Equipment Operator Cost=	$22,104	/50-acre project
Water Truck Operation Cost =	$ 31.00	/hr (L. Stauch/Granite Construction, November 2002)
Number of Water Trucks Require	2	/night (estimated)
Total Hours of Night Operation =	521	hr/year
Total Water Truck Cost=	$32,329	/50-acre project
Total Operation Cost =	$54,433	/50-acre project

Total Cost:

Total Control Cost =	$54,912	/50-acre project

Baseline Emissions:

Construction Site Area =	50	acres
Construction Emission Factors =	0.11	ton PM10/acre-month - non-earthmoving activities (Section 7.7, CARB Area Source Methodologies, August 1997)
=	0.42	ton PM10/acre-month - earthmoving activities (Section 7.7, CARB Area Source Methodologies, August 1997)
Residential Project Duration =	6	months/project (Section 7.7, CARB Area Source Methodologies, August 1997)
Earthmoving Duration =	0.75	months/project (MAG, May 1998)
Non-Earthmoving Emissions =	28.9	ton PM10/project
Earthmoving Emissions =	15.8	ton PM10/project
Total Uncontrolled Project Emissions =	44.6	ton PM10/project
Uncontrolled Nighttime Project Emissions =	17.9	ton PM10/project

Fraction of Construction Site

Under Active Distrubance =	30%	(estimated)
=	15	acres
Number of Water Trucks Operating =	1.5	trucks/site (estimated)
Water Application Rate =	629	gal/acre (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
=	9,435	gal/15 acre disturbed area
Water Truck Capacity =	8,000	gal (assumed)
Surface Coverage Rate =	2.9	acre/hr (Draft Regulation VIII Staff Report, SJVUAPCD, September 2001)
=	1,824	
=	2,736	gal/hr-truck
Watering Time Per Truckload =	2.9	hr/truckload
Water Truck Filling Time =	0.5	hr/truckload (estimated)
Water Truck Effective Watering Time =	3.4	hr/truckload
Effective Surface Coverage Rate =	2,337	gal/hr-truck
Watering Interval =	4.0	hr
Control Efficiency =	49.9%	(Particulate Emission Measurements from Controlled Construction Activities, MRI, April 2001, test series 701)
Baseline Emissions =	8.9	ton PM10/50 acre project

Controlled Emissions:

Number of Water Trucks Operating =	3.5	trucks/site
Effective Surface Coverage Rate =	5,452	gal/hr - 3.5 trucks
Watering Interval =	1.7	hr
Control Efficiency =	78.5%	(Particulate Emission Measurements from Controlled Construction Activities, MRI, April 2001, test series 701)
Controlled Emissions =	3.8	ton PM10/50 acre project

Emission Reduction:

Emission Reduction =	5.1	ton PM10/50 acre project
=	10,214	lb PM10/50 acre project

Cost-Effectiveness:

Cost-Effectiveness =	$10,752	/ton PM10
=	$5.38	/lb PM10

Ban or Discourage Leaf Blower Use on High Pollution Advisory Days

Number: 24
Class: Nonroad Activities

Analysis Unit: Residential Maintenance Day

Total Cost:	**$23.33**
PM10 Reductions (lb):	**2.1**
PM10 Reductions (tons):	**0.00**
C/E Ratio ($/lb):	**$10.93**
C/E Ratio ($/ton):	**$21,851**

Construction/Operational Cost:

Residential Maintenance Cost =	$70 /day (B. Dulla, 1/28/07)
Leaf Blowing Portion =	33% (B. Dulla, 1/28/07)
Leaf Blowing Cost =	$23 /day-residence

Baseline Emissions:

Typical Concrete Surface Requiring Leaf Blowing on Residential Lot =	1500 ft2 (estimated)
Leaf Blowing Emission Factor =	60 mg/m2 (Determination Particulate Emission Rates from Leaf Blowers, UC Riverside, 5/06)
=	0.00142 lb/ft2
Residential Lot Leaf Blowing Emission Rate =	2.14 lb/residence-day

Controlled Emissions:

The cessation of leaf blowing on an advisory day will fully eliminate PM10 from this activity on that day.

Emission Reductions:

Emission Reduction =	2.14 lb/residence-day

Cost-Effectiveness:

Cost-Effectiveness =	$ 10.93 /lb

Encourage Use of Leaf Vacuums to Replace Blowers

Number: 25
Class: Nonroad Activities

Analysis Unit: Vacuum Unit-Operating Day

Total Cost:	**$0.00**
PM10 Reductions (lb):	**0.0**
PM10 Reductions (tons):	**0.00**
C/E Ratio ($/lb):	**NA**
C/E Ratio ($/ton):	**NA**

A study conducted by UC Riverside in 2005 determined that PM10 emissions from leaf vacuums are essentially equal to those leaf blowers. Although not stated in the report, it appears that the collection bags on leaf vacuums are not capable of capturing dust particles, even those up to 100 microns in diameter.

Reduce Off-Road Vehicle Use in High Off-Road Activity Areas (Including Vehicle Impoundment for Repeat Violators)

Number: 26
Class: Nonroad Activities

Analysis Unit: Open Space Acre-Yr

Total Cost:	**$1.31**
PM10 Reductions (lb):	**11.4**
PM10 Reductions (tons):	**0.006**
C/E Ratio ($/lb):	**$0.11**
C/E Ratio ($/ton):	**$230**

Inspection/Enforcement Cost:

Purchase Cost of ATV =	$12,000	(M. Brown/City of Goodyear Police Chief, telecom, 2/12/07)
Useful Life =	8	yr (estimated)
Capital Recovery Factor =	0.187	
Annualized Capital Cost =	$2,249	/yr
Open Space Area in Goodyear =	7,934	(2005 Periodic Emissions Inventory for PM10 for the Maricopa County, Arizona, Nonattainment Area, MCAQD, January 2007)
Annualized Capital Cost =	$0.28	/open space ac-yr
Installed Sign Cost =	$200	(K. McMullen/ADOT, 2/2/07)
Number of Signs Installed in Goodyear =	30	signs (F. Last/City of Goodyear Police Chief, telecom, 2/12/07)
Total Installed Sign Cost =	$6,000	
Useful Life =	20	yr (estimated)
Capital Recovery Factor =	0.117	
Annualized Capital Cost =	$705	/yr
=	$0.09	/open space ac-yr

Assume that flyers on open space disturbance prohibition are mailed annually to all households.

Number of Goodyear Households =	21,300	(estimated from City of Goodyear 2006 population estimate)
Mailout Flyer Cost =	$0.35	/household
=	$7,455	total
=	$0.94	/open space ac-yr
Total Inspection/Enforcement Cost =	$1.31	/open space ac-yr

Baseline Emissions:

Open Space Trespass Emissions =	2,159	ton PM10/yr (2005 Periodic Emissions Inventory for PM10 for the Maricopa County, Arizona, Nonattainment Area, MCAQD, January 2007)
Total Open Space Area =	377,814	ac (C. Arthur email, 2/7/07)
Open Space Trespass Emission Rate =	11.4	lb PM10/open space ac-yr

Controlled Emissions:

Controlled Emissions =	0	lb PM10/open space ac-yr (M. Brown/City of Goodyear Police Chief, telecom, 2/12/07)

Emission Reduction:

Emission Reduction =	11.4	lb PM10/open space ac-yr

Cost-Effectiveness:

Cost-Effectiveness =	$0.11	/lb PM10
=	$229.58	/ton PM10

Create Incentive Fund for Nonroad Diesel Engine Retrofits & Encourage Early Replacements

Number: 27
Class: Nonroad Activities

Analysis Unit: Regionwide

Total Cost:	n/a
PM10 Reductions (lb):	#REF!
PM10 Reductions (tons):	#REF!
C/E Ratio ($/lb):	Infinite
C/E Ratio ($/ton):	#VALUE!

Note: See report for description of cost/benefit calculations.

Update Statutes to Require Ultra-Low Sulfur Diesel Fuels for Nonroad Equipment

Number:	28
Class:	Nonroad Activities
Analysis Unit:	Regionwide
Total Cost:	n/a
PM10 Reductions (lb):	#REF!
PM10 Reductions (tons):	#REF!
C/E Ratio ($/lb):	Infinite
C/E Ratio ($/ton):	#VALUE!

Note: See report for description of cost/benefit calculations.

Sweep Streets With PM10-Certified Street Sweepers

Number: 29
Class: Paved Roads

Analysis Unit: centerline mile-yr

Total Cost:	**$8.66**
PM10 Reductions (lb):	**4,329.9**
PM10 Reductions (tons):	**2.16**
C/E Ratio ($/lb):	**$0.002**
C/E Ratio ($/ton):	**$4.00**

Construction/Operational Cost:

PM10-Certified Sweeper Purchase Cost =	$173,251	- 2005 Elgin Broom Bear(C. Arthur email, 2/22/06)
Non-PM10 Efficiency Sweeper Capital Cost =	$169,786	(MAG, December 2001, adjusted for time)
Difference in Capital Cost =	$3,465	
Useful Life =	8	yr (avg. of estimates by D. Kukino, G. Knight, and D. Moran)
Capital Recovery Factor =	0.187	
Annualized Capital Cost Difference =	$649	/yr

Assume that operation and maintenance costs are the same for certified and non-certified sweepers. Also, assume that a sweeper is used to clean all lanes of a typical four-lane arterial street.

Major Street/Collector Sweeping Schedule =	14	days/circuit (S. Howard/Phoenix, October 2002)
Effective Sweeping Schedule =	6	hr/day (S. Howard/Phoenix, October 2002)
=	5	day/week (S. Howard/Phoenix, October 2002)
Average Sweeping Rate =	5	curb-miles/hr (MAG, December 2001)
=	30	curb-miles/day
=	7.5	centerline-miles/day
=	75	centerline-miles/yr (within the 14-day circuit)
Total Annual Cost =	$649	/yr
=	$8.66	/yr-centerline-mile

Baseline Emissions:

Unswept Street Silt Loading = 0.3 gm/m2 (primary road without trackout in Salt River, Appendix D, Proposed Revised PM10 SIP for the Salt River Area, Arizona DEQ, June 2005)

Emission Factor = $(k)[(sL/2)^{0.65}][(W/3)^{1.5}]$ (AP-42, 13.2.1-1, 1/95)

where:

k =	Particle size factor, fraction
=	0.016 for PM10
s =	Silt content of road surface soil, fraction
L =	Soil loading on road surface, g/m2
W =	Average vehicle weight, tons
C =	Emission factor of PM10 from exhaust, tire wear, and tire wear

k =	0.016	(PM10)
s =	5%	(PM10 Emission Inventory, Engineering-Science, 10/87, p. 2-3, South Central)
L =	6.00	g/m2
W =	3.0	ton/vehicle-avg.

Unontrolled Emission Factor = 0.0047 lb PM10/VMT

Reduction in Street Soil Loading From Sweeping = 55% non-PM10-certified sweeping (PM10-Efficient Street Sweeper Evaluations, CERT/UC Riverside, June 1999)

Equilibrium Return Time = 5.5 days - non-PM10-certified sweeping (Particulate Control Measure Feasibility Study, Sierra Research, August 1996)

Non-PM10-Efficient Sweeping Effectiveness:

Residual Silt Loading =	45%	of Baseline - 1st day after (estimated)
	55%	of Baseline - 2nd day after (estimated)
	65%	of Baseline - 3rd day after (estimated)
	75%	of Baseline - 4th day after (estimated)
	85%	of Baseline - 5th day after (estimated)
	95%	of Baseline - 6th day after (estimated)
	100%	of Baseline - 7th day after (estimated)
Emission Factor =	0.0028	lb/VMT - 1st day after (estimated)
=	0.0032	lb/VMT - 2nd day after (estimated)

=	0.0035	lb/VMT - 3rd day after (estimated)
=	0.0039	lb/VMT - 4th day after (estimated)
=	0.0042	lb/VMT - 5th day after (estimated)
=	0.0045	lb/VMT - 6th day after (estimated)
=	0.0047	lb/VMT - 7th day after (estimated)
=	0.0038	lb/VMT - average for first 7 days after sweeping
=	0.0047	lb/VMT - average for second 7 days after sweeping
=	0.0042	lb/VMT - average for 14 days after sweeping

Traffic Flow Rate = 19,000 vehicles/day (Central Avenue @ Buckeye, 2003 MAG Average Weekday Traffic Volume Map)

Baseline Emission Rate = 80.5 lb PM10/centerline mile-day
= 29,388 lb PM10/centerline mile-yr

Controlled Emissions:

Reduction in Street Soil Loading From Sweeping = 86% non-PM10-certified sweeping (PM10-Efficient Street Sweeper Evaluations, CERT/UC Riverside, June 1999)

Equilibrium Return Time = 8.6 days - non-PM10-certified sweeping (Particulate Control Measure Feasibility Study, Sierra Research, August 1996)

Non-PM10-Efficient Sweeping Effectiveness:

Residual Silt Loading =	14%	of Baseline - 1st day after (estimated)
	24%	of Baseline - 2nd day after (estimated)
	34%	of Baseline - 3rd day after (estimated)
	44%	of Baseline - 4th day after (estimated)
	54%	of Baseline - 5th day after (estimated)
	64%	of Baseline - 6th day after (estimated)
	74%	of Baseline - 7th day after (estimated)
	84%	of Baseline - 8th day after (estimated)
	94%	of Baseline - 9th day after (estimated)
	100%	of Baseline - 10th day after (estimated)
Emission Factor =	0.0013	lb/VMT - 1st day after (estimated)
=	0.0018	lb.VMT - 2nd day after (estimated)
=	0.0023	lb.VMT - 3rd day after (estimated)
=	0.0027	lb.VMT - 4th day after (estimated)
=	0.0031	lb.VMT - 5th day after (estimated)
=	0.0035	lb.VMT - 6th day after (estimated)
=	0.0038	lb.VMT - 7th day after (estimated)
=	0.0042	lb.VMT - 8th day after (estimated)
=	0.0045	lb.VMT - 9th day after (estimated)
=	0.0047	lb.VMT - 10th day after (estimated)
=	0.0032	lb.VMT - average for first 10 days after sweeping
=	0.0047	lb.VMT - average for subsequent 4 days after sweeping
=	0.0036	lb.VMT - average for 14 days after sweeping

Traffic Flow Rate = 19,000 vehicles/day (Central Avenue @ Buckeye, 2003 MAG Average Weekday Traffic Volume Map)

Baseline Emission Rate = 68.7 lb PM10/centerline mile-day
= 25,058 lb PM10/centerline mile-yr

Emission Reduction:

Emission Reduction = 11.9 lb PM10/centerline mile-day
4,330 lb PM10/centerline mile-yr
2.16 ton PM10/centerline mile-yr

Cost-Effectiveness:

Cost-Effectiveness = $4.000 /lb PM10
= $8,000.16 /ton PM10

Retrofit Onroad Diesel Engines

Number: 30
Class: Paved Roads

Analysis Unit: Regionwide

Total Cost:	$0
PM10 Reductions (lb):	0.0
PM10 Reductions (tons):	0.00
C/E Ratio ($/lb):	#DIV/0!
C/E Ratio ($/ton):	#DIV/0!

Note: See report for description of cost/benefit calculations.

Repave or Overlay Paved Roads with Rubberized Asphalt

Number: 31
Class: Paved Roads

Analysis Unit: centerline mile-yr

Total Cost:	$0
PM10 Reductions (lb):	0.0
PM10 Reductions (tons):	0.00
C/E Ratio ($/lb):	#DIV/0!
C/E Ratio ($/ton):	#DIV/0!

Note: See report for description of cost/benefit calculations.

Pave or Stabilize Existing Unpaved Parking Lots (Including Strengthened Enforcement)

Number: 32
Class: Unpaved Parking Lots

Analysis Unit: Parking Lot-Year

	Paving	Palliative
Total Cost:	**$1,699**	**$101**
PM10 Reductions (lb):	**94**	**33**
PM10 Reductions (tons):	**0.05**	**0.02**
C/E Ratio ($/lb):	**$18.10**	**$3.06**
C/E Ratio ($/ton):	**$36,204**	**$6,119**

Note: For measures with multiple cost effectiveness estimates, the mid point was chosen for display.

Paving Option

Construction/Operational Cost:

Maximum Exempt Parking Lot Size = 0.1 ac (MCAQD Rule 310.01)
= 4,356 ft2

Subgrade Preparation Cost = $ 7.80 /yd2 (G. Knight/Phoenix, 1/16/07 email)
Aggregate Subbase Cost = $ 25.00 /ton (G. Knight/Phoenix, 1/16/07 email)
= $ 6.12 /yd2 - 6" depth
Asphalt Paving Cost = $110.00 /ton (G. Knight/Phoenix, 1/16/07 email)
= $17.95 /yd2 - 3" depth
Total Construction Cost = $ 31.87 /yd2
= $ 15,426 /0.1 ac
Useful Life = 25 yr (PM10 BACM, SCAQMD, 9/94)
Capital Recovery Factor = 0.110
Annualized Paving Cost = $1,699 /yr-0.1 ac lot

Baseline Emissions:

Minimum Width of Parking Lot = 44 ft (estimated)
Length of Minimum Parking Lot = 99 ft
Number of Vehicle Trips = 100 vehicles/acre-day (2005 Periodic Emissions Inventory for PM10 for the Maricopa County, Arizona, Nonattainment Area, MCAQD, January 2007)
= 10 vehicles/parking lot-day for 0.1 acre lot
Average Vehicle Trip Travel Distance = 187 ft (assumes entry at one end and exit at other end)
Typical Parking Travel Distance = 1,870 ft/day
= 129 mi/yr

Average Parking Cycle Travel Speed = 5 mph (estimated)

Emission Factor = (k)[(s/12)^a][(S/30)^d]/[(M/0.5)^c] - C (AP-42, 13.2.1-1, 12/03)
where:

k = Particle size factor, fraction
s = Silt content, fraction
S = Speed, mph
M = Surface moisture content, %
C = PM10 emissions from tire wear, brake wear and exhaust

k = 1.8
s = 11.9% (C. Arthur/MAG, 6/16/06 email)
S = 5 mph
M = 0.5% (C. Arthur/MAG, 6/16/06 email)
C = 0.00047 lb PM10/VMT

a = 1
c = 0.2
d = 0.5

Baseline Emission Factor = 0.73 lb PM10/VMT

Baseline Emissions = 0.26 lb PM10/day
= 94 lb PM10/yr

Controlled Emissions:

Emission Factor = (k)[(sL/2)^0.65][(W/3)^1.5] - C (AP-42, 13.2.1-1, 1/95)
where:

k = Particle size factor, fraction
= 0.016 for PM10
s = Silt content of road surface soil, fraction
L = Soil loading on road surface, g/m2
W = Average vehicle weight, tons
C = Emission factor of PM10 from exhaust, tire wear, and tire wear

k = 0.016 (PM10)
s = 0.111 (PM10 Emission Inventory, Engineering-Science, 10/87, Table 2.1, highest paved street silt loading)
L = 6.8 gr/ft2

=	4.74	g/m2
W =	3.0	ton/vehicle-avg.
C =	0.0047	lb/VMT (AP-42, Table 13.2.1-2, 12/03)

Controlled Emission Factor = 0.0020 lb PM10/VMT

Controlled Emissions =	0.0007	lb PM10/parking lot-day
=	0.26	lb PM10/yr

Emission Reduction:

Emission Reduction = 94 lb PM10/parking lot-yr

Cost-Effectiveness:

Cost-Effectiveness = $18.10 /lb PM10

Stabilize Unpaved Parking Lots with Polymer Emulsion Dust Palliative

Construction/Operational Cost:

Maximum Exempt Parking Lot Size =	0.1	ac (MCAQD Rule 310.01)
=	4,356	ft2
Subgrade Preparation Cost =	$ 355	/road-mile (Cost-Effectiveness of Selected Dust Control Measures, prepared for MCDOT by Sierra Research, June 2006)
=	$0.03	/yd2
Polymer Emulsion Application Cost =	$2,596	/road mile - 24' width (K McMullen/MCDOT, 4/24/06)
=	$0.18	/yd2
Total Construction Cost =	$0.21	/yd2
=	$ 101.46	/parking lot-yr (assumes annual subgrade preparation and polymer emulsion application)

Baseline Emissions:

Baseline Emissions =	0.26	lb PM10/day (see paving option above)
=	94.	lb PM10/yr

Controlled Emissions:

Polymer Emulsion Control Efficiency =	35.2%	1-yr average (K. McMullen/MCDOT, 4/24/06)
Controlled Emissions =	0.17	lb PM10/parking lot-day
	61	lb PM10/parking lot-yr

Emission Reduction:

Emission Reduction =	0.09	lb PM10/parking lot-day
=	33	lb PM10/parking lot-yr

Cost-Effectiveness:

Cost-effectiveness = $3.06 /lb PM10

Pave or Stabilize Existing Dirt Roads & Alleys

Number: 33
Class: Unpaved Roads

Analysis Unit: Metropolitan Planning Area (per year)

Total Cost:	**$68,449**
PM10 Reductions (lb):	**971,681**
PM10 Reductions (tons):	**485.84**
C/E Ratio ($/lb):	**$0.07**
C/E Ratio ($/ton):	**$141**

Treatment/Operational Cost:

Treatment	Cost per Mile	Control Efficiency	Cost Effectiveness ($/lb)	Selected Treatment
Soil Sement	$31,563	91.8%	$ 2.70	
Coherex	$10,386	82.0%	$ 1.08	
Ligno 10	$3,052	67.3%	$ 0.50	X (because most cost-effective)
Road Oyl	$22,851	91.6%	$ 1.98	

Unpaved Road Type	Road Miles*	Traffic* (veh/day)	Daily VMT
Total Low Traffic Roads	1129.2	4	4,517
Total High Traffic Roads	224.3	120	26,916

* C. Authur, MAG Inventory

Percent of High Traffic Unpaved Roads Stabilized Each Year with Most Cost-Effective Treatment = 10% (assumed)

Annual Treatment Cost = $68,449

Total Cost:

Total Annual Cost = $68,449

Baseline Emissions:

Uncontrolled Emission Factor = 666.62 g/mile (MAG Inventory)

Uncontrolled Emissions on High Traffic Roads
Before Annual Treatment = 1,443,805 lb/yr

Controlled Emissions:

Treatment Type = Ligno 10
Control Efficiency = 67.3%

Controlled Emissions on High Traffic Roads
After Annual Treatment = 472,124 lb/yr

Emission Reduction:

Emission Reduction = 971,681 lb/yr
= 486 ton/yr
= 21.7 ton/mi

Cost-Effectiveness:

Cost Effectiveness = $0.07 /lb PM-10
= $141 /ton PM-10

Limit Speeds to 15 mph on High Traffic Dirt Roads

Number: 34
Class: Unpaved Roads

Analysis Unit: Road Mile-Year

Total Cost:	**$8,354**
PM10 Reductions (lb):	**18,584**
PM10 Reductions (tons):	**9.29**
C/E Ratio ($/lb):	**$0.45**
C/E Ratio ($/ton):	**$899**

Construction/Operational Cost:

Number of Speed Signs Required		
Required =	13	Estimated from data supplied by (K. McMullen/MCDOT, 1/25/07 email) signs placed every 1/4th mile
Sign Installation Cost =	$250	/sign (K. McMullen/MCDOT, January 2006)
Total Sign Installation Cost =	$3,250	/road mile
Useful Life =	15	yr (K. McMullen/MCDOT, January 2006)
Capital Recovery Factor =	0.131	
Annualized Sign Cost =	$427	/yr
Total Construction Cost =	$142	/targeted road mile/year

Inspection/Enforcement Cost:

Purchase Cost of Handheld Radar:	$795	(www.radar-gun.com, 1/25/07)
Useful Life =	8	yr (estimated)
Capital Recovery Factor =	0.187	
Annualized Capital Cost =	$149.02	/yr

Assume that one Maricopa County Deputy Sheriff is assigned to enforce traffic speeds on targeted unpaved roads with more than 120 but less than 150 vehicles-per-day traffic counts.

Deputy Sheriff Salary =	$ 10,000	/yr Estimate assumes roughly 1/4 time spent enforcing speeds on targeted unpaved roads
Number of Speeding Tickets Issued =	4	/day (estimated)
=	1,043	/yr
Clerical Time Required =	1	hr/ticket
=	1,043	hr/yr
Clerical Salary Rate =	$ 13.89	/hr (Bureau of Labor Statistics, May 2005 MSA Wage Estimates for Phoenix, mean for Office & Admin Support)
Clerical Cost =	$ 14,485	/yr
Number of Unpaved Road-Miles To Be Patrolled =	3	miles estimated from data supplied by Kelly McMullen (1/25/07) email
Total Enforcement Cost =	$ 24,634	/yr
=	$ 8,211	/road mile-yr

Total Cost:

Total Cost =	$ 8,354	/road mile-yr

Baseline Emissions:

Emission Factor = (k)[(s/12)^a][(S/30)^d]/[(M/0.5)^c] - C

where:

k =	Particle size factor, fraction
s =	Silt content, fraction
S =	Speed, mph
M =	Surface moisture content,%
C =	PM10 emissions from tire wear, brake wear and exhaust

k =	1.8	
s =	11.9%	(C. Arthur/MAG, 6/16/06 email)
S =	25	mph (C. Arthur/MAG, 6/16/06 email)
M =	0.5%	(C. Arthur/MAG, 6/16/06 email)
C =	0.00047	lb PM10/VMT
a =	1	
c =	0.2	
d =	0.5	

Baseline Emission Factor =	1.63	lb PM10/VMT
Total Vehicles Miles Travelled on Targeted Unpaved Roads =	594.10	VMT (K. McMullen/MCDOT, 1/25/07 email)
Baseline Emissions =	968	lb PM10/day
=	323	lb PM10/road mile-day
=	117,748	lb PM10/road mile-yr

Controlled Emissions:

Emission Factor = (k)[(s/12)^a][(S/30)^d]/[(M/0.5)^c] - C

where:

k =	Particle size factor, fraction	
s =	Silt content, fraction	
S =	Speed, mph	
M =	Surface mositure content,%	
C =	PM10 emissions from tire wear, brake wear and exhaust	
k =	1.8	
s =	11.9%	(C. Arthur/MAG, 6/16/06 email)
S =	15	mph
M =	0.5%	(C. Arthur/MAG, 6/16/06 email)
C =	0.00047	lb PM10/VMT
a =	1	
c =	0.2	
d =	0.5	

Controlled Emission Factor =	1.26	lb PM10/VMT
Compliance Fraction =	70%	(estimated)
Adjusted Controlled Emission Factor =	1.37	lb PM10/VMT
Controlled Emissions =	815	lb PM10/day
=	272	lb PM10/road mile-day
=	99,164	lb PM10/road mile-yr

Emission Reduction:

Emission Reduction =	50.9	lb PM10/road mile-day
=	18,584	lb PM10/road mile-yr

Cost-Effectiveness:

Cost-Effectiveness = $ 0.45 /lb PM10

Prohibit New Dirt Roads Including Those Associated With Lot Splits

Number: 35
Class: Unpaved Roads

Analysis Unit: Road mile-year

Total Cost:	**$44,067**
PM10 Reductions (lb):	**33,308**
PM10 Reductions (tons):	**16.65**
C/E Ratio ($/lb):	**$1.32**
C/E Ratio ($/ton):	**$2,646**

Construction/Operational Cost:

Reconstruction Cost =	$400,000	/centerline-mile (including roadway excavation, aggregate base, striping, and traffic control, L. Stauch/Granite Construction, November 2002)
Useful Life =	25	yr (PM10 BACM, SCAQMD, 9/94)
Capital Recovery Factor =	0.110	
Annualized Paving Cost =	$44,067	/mile-yr

Baseline Emissions:

Typical Number of Residences on Unpaved Public Road =	6	residences (M. Zeldin email, 1/6/03)
Number of Daily Trips =	77.9	one-way trips/day - 6 residences (URBEMIS7G Manual, Table 2, October 2000)
Fraction of Trips Starting or Ending at Home =	72%	(URBEMIS7G Manual, App. C)
Minimum Vehicle Trips =	56.1	one-way trips/day-6 residences
Average Trip Length =	1.0	mile (assumed)
Daily Mileage Traveled =	56.1	VMT/road mile-day
Unpaved Road Travel Emission Factor =	1.63	lbs PM10/VMTf (see Measure 34 analysis)
Baseline Emissions =	91.4	lb PM10/day - centerline-mile
=	33,349	lb PM10/yr - centerline-mile

Controlled Emissions:

Paved Road Travel Emission Factor =	0.00201963	lb PM10/VMT
Controlled Emissions =	0.11	lb PM10/day - centerline-mile
	41.3	lb PM10/yr - centerline-mile

Emission Reduction:

Emission Reduction =	33,308	lb PM10/yr - centerline-mile

Cost-Effectiveness:

Cost-Effectiveness =	$1.32	/lb PM10
	$2,646	/ton PM10

Pave or Stabilize Unpaved Shoulders

Number: 36
Class: Unpaved Shoulders

Analysis Unit: Centerline Mile-Yr

Total Cost:	**$25,104**
PM10 Reductions (lb):	**2,721**
PM10 Reductions (tons):	**1.36**
C/E Ratio ($/lb):	**$9.23**
C/E Ratio ($/ton):	**$18,452**

Construction/Operational Cost:

Construction Cost =	$208,000	/centerline mile (G. Knight, 3/22/06, from parking lot paving data)
Useful Life =	20	yr (estimated)
Capital Recovery Factor =	0.117	
Annualized Capital Cost =	$24,432	/centerline mile-yr
Slurry Seal Maintenance Cost =	$5,726	/centerline mile (D. Moran, 3/15/06)
Year of Application =	10	yr (estimated)
Present Net Worth of Slurry Seal	$2,208	at time of paved shoulder construction
Useful Life =	20	yr (estimated)
Capital Recovery Factor =	0.117	
Annualized Capital Cost =	$673	/centerline mile-yr
Total Annual Cost =	$25,104	/centerline mile-yr

Baseline Emissions:

Truck Wake Emission Factor =	0.016	lb PM10/mile-truck (DRI, 1996, adjusted to 40 mph)
Average Truck Traffic Fraction =	3%	(MAG Regional Freeway Bottleneck Study, May 2002)
Average Daily Arterial Traffic Volume =	20,488	vehicles/day (2003 Weekday Traffic Data, MAG, 9/04)
Average Truck Traffic Level =	615	trucks/day
Daily Truck Wake Emission Rate	9.8	lb PM10/mile-day
Annual Truck Wake Emission Rate =	3,589	lb PM10/mile-yr
Unpaved Shoulder Traffic =	410	LDT vehicle entrances/day (estimated)
	6	18-wheel vehicle entrances/day (estimated)
Deposition to Paved Road =	0.0033	lb/pickup-pass (Particulate Emission Measurement from Controlled Construction Activities, EPA/600/R-01/031, EPA, April 2001)
=	0.0008	lb/vehicle tire-pass
=	0.0021	lb/18-wheel heavy duty truck tire (based on tread area and wheel force ratios)
=	0.0378	lb/18-wheel truck
Deposition to Paved Road Rate =	1.57	lb soil/mile-day
Deposition Fraction Emitted as PM10 =	30%	(M. Zeldin email, 10/8/02)
Deposition Emitted as PM10 =	0.47	lb PM10/mile-day
=	172	lb PM10/mile-yr
Baseline Emissions =	3,761	lb PM10/mile-yr

Controlled Emissions:

No study of the control effectiveness of centerline shoulder paving on road shoulder/truck bow wake emissions has been conducted.

Estimated Control Efficiency of 8-Foot Road Shoulder Paving on Truck Wake Emissions =	75%	(estimated)
Control Efficiency of 8-Foot Road Shoulder Paving on Trackout Emissions =	17%	(Particulate Emission Measurements from Controlled Construction Activities, EPA/600/R-01/031, EPA, April 2001, multiplied by 0.4 to account for reduced width)
Controlled Emissions =	1,040	lb PM10/centerline mile-yr

Emission Reduction:

Emission Reduction =	2,721	lb PM10/centerline mile-yr

Cost-Effectiveness:

Cost-Effectiveness =	$9.23	/lb PM10
=	$18,452	/ton PM10

#N/A

Number: 37a
Class: #N/A

Analysis Unit: Access Point/Yr

Total Cost:	**$3,501**
PM10 Reductions (lb):	**214.8**
PM10 Reductions (tons):	**0.11**
C/E Ratio ($/lb):	**$16**
C/E Ratio ($/ton):	**$32,593**

Construction/Operational Cost:

Sweeping Cost =	$65	/centerline-mile - scheduled contract service K. McMullen, 6/28/06)
=	$33	/lane-mile - scheduled contract service
Length of Trackout =	455	ft (minimum measured in Salt River TSD, ADEQ, 9/05)
Sweeping Frequency =	5	times per day (assumed)
Operating Schedule =	250	day/yr (estimated)
Annual Sweeping and Travel Distance =	108	mi/yr
Total Annual Cost =	$3,501	/yr-access point

Baseline Emissions:

Daily Operating Rate =	10	hr/day (assumed)
Minimum Access Point Traffic Volume =	8	heavy duty truck crossings/hr (assumed)
=	4	heavy duty truck exits/hr
=	80	heavy duty truck crossings/day
=	40	heavy duty truck exits/day
Uncontrolled Deposition to Paved Road =	0.0033	lb/light duty vehicle-exit (Particulate Emission Measurement from Controlled Construction Activities, EPA/600/R-01/031, EPA, April 2001)
=	0.0008	lb/pickup tire-pass
=	0.0021	lb/18-wheel heavy duty truck tire (based on tread area and wheel force ratios)
=	0.0378	lb/18-wheel truck
Control Efficiency of 20 Foot Paved Approach =	42%	(MRI, April 2001)
Rule 310 Required Paved Approa	100	ft (Rule 310, Table 17)
Control Efficiency of 100 Foot Paved Approach =	81.4%	
Controlled Deposition to Paved Road =	0.0070	lb/18-wheel truck
Deposition to Paved Road Rate =	0.28	lb soil/facility-day
Deposition Fraction Emitted as PM10 =	30%	(M. Zeldin email, 10/8/02)
Increase in Street Emission Rate =	0.08	lb PM10/facility-day
=	30.9	lb PM10/facility-yr

Controlled Emissions:

Salt River Traffic Volume =	19,000	vehicles/day (27th Avenue, 2002, 2003 Average Weekday Traffic, MAG,9/04)
=	4,750	vehicles/lane-day
=	356	average hourly traffic-1 lane, mid-day
Street Surface Deposition Length=	455	ft (estimated)
Street Surface Deposition Width =	12	ft (estimated)
Street Surface Deposition Area =	5,460	ft2
Initial Street Soil Loading =	2.45	gr/ft2 (PM10 Emission Inventory, Engineering-Science, 10/87, p. 2-3, South Central)
=	1.71	g/m2
Average Silt Content =	5%	(PM10 Emission Inventory, Engineering-Science, 10/87, p. 2-3, South Central)
Initial Street Silt Loading =	0.09	g/m2
Average Vehicle Weight =	3.0	ton/vehicle-avg.

Initial Street Vehicle Emission Factor = 0.0021 lb PM10/VMT (AP-42, 13.2.1-1, 1/95)
Deposition Area Length = 455 ft
= 0.0862 mile
Deposition Area Initial Emission Rate = 0.0633 lb PM10/hr, mid-day
Deposition Area Background Deposition Rate = 0.2109 lb soil/hr, mid-day

Maximum Emission Rate Increase From Facility Deposition = 0.0085 lb PM10/hr, mid-day
Maximum Cumulative Deposition Area Emission Rate = 0.0717 lb PM10/hr, mid-day
= 0.0023 lb PM10/VMT, mid-day
Equilibrium Silt Loading = 0.1036 g/m2 (AP-42. 13.2.1-1, 1/95)
= 0.000021 lb/ft2
Equilibrium Soil Loading = 0.0004 lb/ft2
Equilibrium Deposition Area Soil Load = 2.32 lb/deposition area
Initial Deposition Area Soil Load = 2.45 gr/ft2
1.91 lb/deposition area
Deposition Area Soil Load Increase from Facility Traffic = 0.41 lb/deposition area
Soil Transfer Rate from Facility to Deposition Area = 0.028 lb/hr
Time to Reach Equilibrium = 14.43 hr

Control effectiveness will be optimized if the interval between sweepings is kept shorter than the time to reach equilibrium street soil loading conditions.

Interval Between Sweepings = 2.0 hr (assumed)
Number of Sweepings Per Day = 5 sweepings/day

Sweep 1 Hour	Initial Soil Load (lb/area)	Bckgnd Deposition (lb/area)	Track-out Soil Deposition (lb/area)	Area PM10 Emission Rate (lb/area)	Non-PM10 Soil Loss (lb/area)	Final Soil Load (lb/area)
1	1.9110	0.2109	0.0282	0.0633	0.2109	1.9392
2	1.9392	0.2109	0.0282	0.0639	0.2129	1.9654

Pre-Sweeping Area Soil Load = 1.9654 lb/deposition area
Reduction in Street Soil Loading From Sweeping = 86% (estimated from sweeper test data)
Post-Sweeping Area Soil Load = 0.2752 lb/deposition area

Sweep 2 Hour	Initial Soil Load (lb/area)	Bckgnd Deposition (lb/area)	Track-out Soil Deposition (lb/area)	Area PM10 Emission Rate (lb/area)	Non-PM10 Soil Loss (lb/area)	Final Soil Load (lb/area)
3	0.2752	0.2109	0.0282	0.0180	0.0598	0.4544
4	0.4544	0.2109	0.0282	0.0249	0.0829	0.6106

Pre-Sweeping Area Soil Load = 0.6106 lb/deposition area
Reduction in Street Soil Loading From Sweeping = 86% (estimated from sweeper test data)
Post-Sweeping Area Soil Load = 0.0855 lb/deposition area

Sweep 3 Hour	Initial Soil Load (lb/area)	Bckgnd Deposition (lb/area)	Track-out Soil Deposition (lb/area)	Area PM10 Emission Rate (lb/area)	Non-PM10 Soil Loss (lb/area)	Final Soil Load (lb/area)
5	0.0855	0.2109	0.0282	0.0084	0.0280	0.2966
6	0.2966	0.2109	0.0282	0.0188	0.0628	0.4728

Pre-Sweeping Area Soil Load = 0.4728 lb/deposition area
Reduction in Street Soil Loading From Sweeping = 86% (estimated from sweeper test data)
Post-Sweeping Area Soil Load = 0.0662 lb/deposition area

Sweep 4 Hour	Initial Soil Load (lb/area)	Bckgnd Deposition (lb/area)	Track-out Soil Deposition (lb/area)	Area PM10 Emission Rate (lb/area)	Non-PM10 Soil Loss (lb/area)	Final Soil Load (lb/area)
7	0.0662	0.2109	0.0282	0.0071	0.0237	0.2816

8	0.2816	0.2109	0.0282	0.0182	0.0607	0.4599

Pre-Sweeping Area Soil Load = 0.4599 lb/deposition area
Reduction in Street Soil Loading
From Sweeping = 86% (estimated from sweeper test data)
Post-Sweeping Area Soil Load = 0.0644 lb/deposition area

Sweep 5

Hour	Initial Soil Load (lb/area)	Bckgnd Deposition (lb/area)	Track-out Soil Deposition (lb/area)	Area PM10 Emission Rate (lb/area)	Non-PM10 Soil Loss (lb/area)	Final Soil Load (lb/area)
9	0.0644	0.2109	0.0282	0.0070	0.0233	0.2802
10	0.2802	0.2109	0.0282	0.0182	0.0605	0.4587

Pre-Sweeping Area Soil Load = 0.4587 lb/deposition area
Reduction in Street Soil Loading
From Sweeping = 86% (estimated from sweeper test data)
Post-Sweeping Area Soil Load = 0.0642 lb/deposition area

Hour	Initial Soil Load (lb/area)	Bckgnd Deposition (lb/area)	Track-out Soil Deposition (lb/area)	Area PM10 Emission Rate (lb/area)	Non-PM10 Soil Loss (lb/area)	Final Soil Load (lb/area)
11	0.0642	0.2109	0.0000	0.0070	0.0232	0.2519
12	0.2519	0.2109	0.0000	0.0169	0.0565	0.4063
13	0.4063	0.2109	0.0000	0.0231	0.0771	0.5401
14	0.5401	0.2109	0.0000	0.0278	0.0928	0.6582
15	0.6582	0.2109	0.0000	0.0316	0.1055	0.7636
16	0.7636	0.2109	0.0000	0.0349	0.1162	0.8583
17	0.8583	0.2109	0.0000	0.0376	0.1253	0.9439
18	0.9439	0.2109	0.0000	0.0400	0.1333	1.0214
19	1.0214	0.2109	0.0000	0.0421	0.1404	1.0920
20	1.0920	0.2109	0.0000	0.0440	0.1466	1.1563
21	1.1563	0.2109	0.0000	0.0456	0.1521	1.2150
22	1.2150	0.2109	0.0000	0.0471	0.1571	1.2688
23	1.2688	0.2109	0.0000	0.0485	0.1616	1.3181
24	1.3181	0.2109	0.0000	0.0497	0.1657	1.3633

Controlled 24-Hour Emission Rate 0.7437 lb PM10/area-day
Uncontrolled 24-Hour Emission R: 1.6030 lb PM10/area-day

Emission Reduction:

Emission Reduction = 0.8593 lb PM10/facility-operating day
215 lb PM10/facility-yr

Cost-Effectiveness:

Cost-Effectiveness = $16.30 /lb PM10
= $32,593 /ton PM10

#N/A

Number: 37b
Class: #N/A

Analysis Unit: Access Point/Yr

Total Cost:	**$2,965**
PM10 Reductions (lb):	**33.10**
PM10 Reductions (tons):	**0.02**
C/E Ratio ($/lb):	**$89.57**
C/E Ratio ($/ton):	**$179,133**

Construction/Operational Cost:

Typical Gravel Bed Construction Cost =	$750	/yr (A. Bashor/Clark County, November 2002, adjusted to 2006)
Double-sized Gravel Bed Construction Cost =	$1,500	/yr
Typical Maintenance Time =	4	man-hr/month (estimated)
=	48	man-hr/yr
Double-sized Gravel Bed Maintenance Time =	96	man-hr/yr
Laborer Rate =	$15.26	/hr (Bureau of Labor Statistics, USDL - Phoenix AZ)
Maintenance Cost =	$1,465	/yr
Total Annual Cost =	$2,965	/yr

Baseline Emissions:

Access Point Traffic Level =	80	vehicle trips/day (assumed)
	40	exiting trips/day
Deposition to Paved Road =	0.0033	lb/pickup-pass (Particulate Emission Measurement from Controlled Construction Activities, EPA/600/R-01/031, EPA, April 2001)
=	0.0008	lb/pickup tire-pass
=	0.0021	lb/18-wheel heavy duty truck tire (based on tread area and wheel force ratios)
=	0.0378	lb/18-wheel truck
Deposition to Street Rate =	1.51	lb soil/day-access point
Deposition Fraction Emitted as PM10 =	30%	(M. Zeldin email, 10/8/02)
Deposition Emitted as PM10 =	0.45	lb PM10/day-access point
Number of Facility Annual Operating Days =	250	day/yr (estimated)
Increase in Street Emission Rate	0.45	lb PM10/day-access point
=	113.5	lb PM10/yr-access point
50' Gravel Bed Control Efficiency =	46%	(Particulate Emission Measurements from Controlled Construction Activities, EPA/600/R-01/031, EPA, April 2001)
Baseline Emissions =	61.30	lb PM10/yr-access point

Controlled Emissions:

50' Gravel Bed Control Efficiency =	46%	(Particulate Emission Measurements from Controlled Construction Activities, EPA/600/R-01/031, EPA, April 2001)
100' Gravel Bed Control Efficiency =	75%	(estimated, assumes same efficiency for second 50' section)
Controlled Emission Rate =	0.11	lb PM10/access point-day
=	28.20	lb PM10/access point-yr

Emission Reduction:

Emission Reduction =	33.10	lb PM10/access point-yr

Cost-Effectiveness:

Cost-Effectiveness =	$89.57	/lb PM10
	$179,133	/ton PM10

Pave or Stabilize Unpaved Access to Paved Roads

Number: 37
Class: Fugitive Dust Control

Analysis Unit: Access Point/Yr

Total Cost:	**$4,120**
PM10 Reductions (lb):	**49.04**
PM10 Reductions (tons):	**0.02**
C/E Ratio ($/lb):	**$84.01**
C/E Ratio ($/ton):	**$168,025**

Note: For measures with multiple cost effectiveness estimates, the mid point was chosen for display.

Construction/Operational Cost:

Typical Gravel Bed Construction Cost =	$750	/yr (A. Bashor/Clark County, November 2002, adjusted to 2006)
Maintenance Time =	2	man-hr/month (estimated)
=	24	man-hr/yr
Laborer Rate =	$15.26	/hr (Bureau of Labor Statistics, USDL - Phoenix AZ)
Maintenance Cost =	$366	/yr
Grizzly Cost =	$7,200	(10' wide x 24' long - J. Lane/Trackout Control www.trackoutcontrol.com, 1/25/07)
Useful Life =	4	yr (estimated)
Capital Recovery Factor =	0.315	
Annualized Capital Cost =	$2,271	/yr
Maintenance Time =	4	man-hr/month (estimated)
=	48	man-hr/yr
Laborer Rate =	$15.26	/hr (Bureau of Labor Statistics, USDL - Phoenix AZ)
Maintenance Cost =	$732	/yr
Total Annual Cost =	$4,120	/yr-access point

Baseline Emissions:

Access Point Traffic Level =	80	vehicle trips/day (assumed)
	40	exiting trips/day
Deposition to Paved Road =	0.0033	lb/pickup-pass (Particulate Emission Measurement from Controlled Construction Activities, EPA/600/R-01/031, EPA, April 2001)
=	0.0008	lb/pickup tire-pass
=	0.0021	lb/18-wheel heavy duty truck tire (based on tread area and wheel force ratios)
=	0.0378	lb/18-wheel truck
Deposition to Street Rate =	1.51	lb soil/day-access point
Deposition Fraction Emitted as PM10 =	30%	(M. Zeldin email, 10/8/02)
Deposition Emitted as PM10 =	0.45	lb PM10/day-access point
Number of Facility Annual Operating Days =	250	day/yr (estimated)
Increase in Street Emission Rate	0.45	lb PM10/day-access point
=	113.5	lb PM10/yr-access point
50' Gravel Bed Control Efficiency =	46%	(Particulate Emission Measurements from Controlled Construction Activities, EPA/600/R-01/031, EPA, April 2001)
Baseline Emissions =	61.3	lb PM10/yr-access point

Controlled Emissions:

Gravel Bed Control Efficiency =	46%	(Particulate Emission Measurements from Controlled Construction Activities, EPA/600/R-01/031, EPA, April 2001)
Grizzly Control Efficiency =	80%	(R. Polita/Maricopa Co. telecon, 9/24/02)
Overall Control Efficiency =	89%	
Controlled Emission Rate =	0.05	lb PM10/day-access point
=	12.26	lb PM10/yr-access point

Emission Reduction:

Emission Reduction =	49.04	lb PM10/yr-access point

Cost-Effectiveness:

Cost-Effectiveness =	$84.01	lb PM10/yr-access point
	$168,025	/ton PM10

Strengthen & Increase Enforcement of Rule 310.01 for Vacant Lots

Number: 38
Class: Vacant Lots

Analysis Unit: vacant lot-yr

Total Cost:	**$1,390**
PM10 Reductions (lb):	**87.4**
PM10 Reductions (tons):	**0.04**
C/E Ratio ($/lb):	**$15.91**
C/E Ratio ($/ton):	**$31,814**

Inspection/Enforcement Cost:

Number of Vacant Lots =	4,000	- PM10 nonattainment area (T. Shin/MAG, 2/9/07)
Number of New Inspectors Dedicated to Vacant Lot Inspection =	2	(J. Crumbaker telecon, 2/7/07)
Inspector Labor Rate =	$24.09	/hr (J. Crumbaker/MCAQD, 1/23/07)
=	$50,200	/yr (J. Crumbaker/MCAQD, 1/23/07)
Annual Vacant Lot Inspection Cost =	$25.10	/vacant lot-yr
Number of Daily Inspections Conducted =	12	/day-inspector (estimated)
Number of Annual Inspections Conducted =	3,009	/yr-inspector
=	6,017	/yr total
Vacant Lot Inspection Frequency =	1.50	/yr
Rule 310.01 Compliance Rate =	68%	- vacant lots (MCAQD rule effectiveness study)
Number of Annual NOVs Issued =	1,925	/yr total
Vacant Lot NOV Frequency =	0.48	/vacant lot-yr
Clerical Processing Time =	2	hr/NOV (estimated)
Clerical Rate =	$ 13.89	/hr (Maricopa County, 8/13/96)
Clerical Cost =	$ 13.37	/vacant lot-yr
Supervisor Processing Time =	1	hr/NOV (estimated)
Supervisor Rate =	$20.67	/hr (Maricopa County, 8/13/96)
Supervisor Cost =	$9.95	/vacant lot-yr
Total Inspection and Enforcement Cost =	$48.42	/vacant lot-yr

Construction/Operational Cost:

Rock Barrier Rate =	$7.90	/lin ft (Proposed Revised PM10 SIP for the Salt River Area, Arizona DEQ, June 2005)
Average Vacant Lot Area =	3	acres (estimated from land use map in Salt River PM10 SIP, Arizona DEQ, June 2005)
Average Vacant Lot Boundary =	1446	ft
Rock Barrier Cost =	$ 11,423	/vacant lot
Useful Life =	20	yr (estimated)
Capital Recovery Factor =	0.117	
Annualized Barrier Cost =	$1,341.78	/vacant lot-yr

Total Cost:

Total Cost =	$1,390.20	/vacant lot-yr

Baseline Emissions:

Trespass Emissions

Average Vacant Lot Trespass Rate =	2	trips/week (estimated)
Average Trespass Trip Distance =	361	ft (estimated)

Emission Factor = (k)[(s/12)^a][(S/30)^d]/[(M/0.5)^c] - C

where:

k =	Particle size factor, fraction	
s =	Silt content, fraction	
S =	Speed, mph	
M =	Surface moisture content, %	
C =	PM10 emissions from tire wear, brake wear and exhaust	
k =	1.8	
s =	11.9%	(C. Arthur/MAG, 6/16/06 email)
S =	25	mph (C. Arthur/MAG, 6/16/06 email)
M =	0.5%	(C. Arthur/MAG, 6/16/06 email)
C =	0.00047	lb PM10/VMT
a =	1	
c =	0.2	
d =	0.5	

Baseline Emission Factor = 1.63 lb PM10/VMT

Annual Tresspass Emissions = 11.6 lb PM10/vacant lot-yr

Windblown Emissions

Average Lot Size = 3.0 acres (estimated from land use map in Salt River PM10 SIP, Arizona DEQ, June 2005)

Average Trespass Distance = 361 ft (estimated)

Average Trespass Width = 20 ft (estimated)

Average Trespass Area = 7230 ft2
= 0.1660 acre

Windblown Dust
Emission Factor = 6.22E-08 g/cm2-sec (Salt River TSD, 9/05)
= 0.0005 lb/ft2-hr

Number of Annual
High Wind Hours = 23 hr/yr (PM10 Emission Inventory, Engineering-Science, 10/87, Table 3.8)

Annual Windblown Emissions = 75.8 lb PM10/vacant lot-yr

Total Annual Emissions = 87.4 lb PM10/vacant lot-yr

Controlled Emissions:

Controlled Emissions = 0.0 lb PM10/vacant lot-yr

Emission Reduction:

Emission Reduction = 87.4 lb PM10/vacant lot-yr

Cost-Effectiveness:

Cost-Effectiveness = $ 15.91 /lb PM10
= $ 31,814 /ton PM10

Restrict Vehicular Use & Parking on Vacant Lots

Number: 39
Class: Vacant Lots

Analysis Unit: vacant lot-yr

Total Cost:	**$1,342**
PM10 Reductions (lb):	**87.4**
PM10 Reductions (tons):	**0.04**
C/E Ratio ($/lb):	**$15.35**
C/E Ratio ($/ton):	**$30,706**

Construction/Operational Cost:

Rock Barrier Rate = $7.90 /lin ft (Proposed Revised PM10 SIP for the Salt River Area, Arizona DEQ, June 2005)

Average Vacant Lot Area = 3 acres (estimated from land use map in Salt River PM10 SIP, Arizona DEQ, June 2005)

Average Vacant Lot Boundary = 1446 ft
Rock Barrier Cost = $ 11,423 /vacant lot

Useful Life = 20 yr (estimated)
Capital Recovery Factor = 0.117
Annualized Barrier Cost = $1,342 /vacant lot-yr

Baseline Emissions:

Trespass Emissions

Average Vacant Lot Trespass Rate = 2 trips/week (estimated)
Average Trespass Trip Distance = 361 ft (estimated)

Emission Factor = (k)[(s/12)^a][(S/30)^d]/[(M/0.5)^c] - C
where:

k = Particle size factor, fraction
s = Silt content, fraction
S = Speed, mph
M = Surface moisture content, %
C = PM10 emissions from tire wear, brake wear and exhaust

k = 1.8
s = 11.9% (C. Arthur/MAG, 6/16/06 email)
S = 25 mph (C. Arthur/MAG, 6/16/06 email)
M = 0.5% (C. Arthur/MAG, 6/16/06 email)
C = 0.00047 lb PM10/VMT

a = 1
c = 0.2
d = 0.5

Baseline Emission Factor = 1.63 lb PM10/VMT

Annual Tresspass Emissions = 11.6 lb PM10/vacant lot-yr

Windblown Emissions

Average Lot Size = 3.0 acres (estimated from land use map in Salt River PM10 SIP, Arizona DEQ, June 2005)

Average Trespass Distance = 361 ft (estimated)

Average Trespass Width = 20 ft (estimated)

Average Trespass Area = 7230 ft2
= 0.1660 acre

Windblown Dust Emission Factor = 6.22E-08 g/cm2-sec (Salt River TSD, 9/05)
= 0.0005 lb/ft2-hr

Number of Annual High Wind Hours = 23 hr/yr (PM10 Emission Inventory, Engineering-Science, 10/87, Table 3.8)

Annual Windblown Emissions = 75.8 lb PM10/vacant lot-yr

Total Annual Emissions = 87.4 lb PM10/vacant lot-yr

Controlled Emissions:

Controlled Emissions = 0.0 lb PM10/vacant lot-yr

Emission Reduction:

Emission Reduction = 87.4 lb PM10/vacant lot-yr

Cost-Effectiveness:

Cost-Effectiveness = $ 15.35 /lb PM10
= $ 30,706 /ton PM10

Enhanced Enforcement of Trespass Ordinances & Codes

Number: 40
Class: Vacant Lots

Analysis Unit: vacant lot-yr

Total Cost:	**$224.97**
PM10 Reductions (lb):	**56.5**
PM10 Reductions (tons):	**0.03**
C/E Ratio ($/lb):	**$3.98**
C/E Ratio ($/ton):	**$7,961**

Construction/Operational Cost:

No Trespassing Sign Installed Cost =		$208	(K. McMullen/MCDOT, 2/2/07)
Sign Spacing =		200	ft (estimated)
Average Vacant Lot Perimeter =		1446	ft (see Measure 39 analysis)
Number of Signs =		7	signs/vacant lot
Sign Cost =	$	1,456	/vacant lot
Useful Life =		15	yr (estimated)
Capital Recovery Factor =		0.131	
Annualized Barrier Cost =		$191.43	/vacant lot-yr

Inspection/Enforcement Cost:

Number of Vacant Lots = 4,000 - PM10 nonattainment area (T. Shin/MAG, 2/9/07)

Assume that enforcement is performed by 2 officers in one car per analysis reported in Proposed Revised PM10 SIP for the Salt River Area, Arizona DEQ, June 2005

Law Enforcement Cost =	$	126,945	/yr (Proposed Revised PM10 SIP for Salt River Area, Arizona DEQ, June 2005)
=	$	31.74	/vacant lot-yr
Number of Citations Issued =		2	citations/day - estimated
=		521	citations/yr
=		0.13	citations/vacant lot-yr
Clerical Processing Time =		1	hr/citation (estimated)
Clerical Rate =	$	13.89	/hr (Bureau of Labor Statistics, May 2005 MSA Wage Estimates for Phoenix, mean for Office & Admin Support)
Clerical Cost =	$	13.89	/citation
=	$	1.81	/vacant lot-yr
Total Enforcement Cost =	$	33.55	/vacant lot-yr

Total Cost:

Total Cost = $224.97 /vacant lot-yr

Baseline Emissions:

Trespass Emissions

Average Vacant Lot Trespass Rate =	2	trips/week (estimated)
Average Trespass Trip Distance =	361	ft (see Measure 39 analysis)

Emission Factor = (k)[(s/12)^a][(S/30)^d]/[(M/0.5)^c] - C

where:

k =		Particle size factor, fraction
s =		Silt content, fraction
S =		Speed, mph
M =		Surface moisture content, %
C =		PM10 emissions from tire wear, brake wear and exhaust
k =	1.8	
s =	11.9%	(C. Arthur/MAG, 6/16/06 email)
S =	25	mph (C. Arthur/MAG, 6/16/06 email)
M =	0.5%	(C. Arthur/MAG, 6/16/06 email)
C =	0.00047	lb PM10/VMT
a =	1	
c =	0.2	

d =	0.5	
Baseline Emission Factor =	1.63	lb PM10/VMT
Annual Trespass Emissions =	11.6	lb PM10/vacant lot-yr

Windblown Emissions

Average Lot Size =	3.0	acres (estimated from land use map in Salt River PM10 SIP, Arizona DEQ, June 2005)
Average Trespass Distance =	361	ft (estimated)
Average Trespass Width =	20	ft (estimated)
Average Trespass Area =	7230	ft2
=	0.1660	acre
Windblown Dust Emission Factor =	6.22E-08	g/cm2-sec (Salt River TSD, 9/05)
=	0.0005	lb/ft2-hr
Number of Annual High Wind Hours =	23	hr/yr (PM10 Emission Inventory, Engineering-Science, 10/87, Table 3.8)
Annual Windblown Emissions =	75.8	lb PM10/vacant lot-yr
Total Annual Emissions =	87.4	lb PM10/vacant lot-yr

Controlled Emissions:

Reduction in Tresspass Resulting From Enforcement Activities =	75%	(estimated)
Controlled Trespass Emissions =	2.91	lb PM10/vacant lot-yr
Vacant Lot Stabilization Rule Effectiveness =	68%	(Rule Effectiveness Study Maricopa County Rules 210, 310.01, and 316, MCAQD, January 2007)
Controlled Windblown Emissions:	27.97	lb PM10/vacant lot-yr
Total Controlled Emissions =	30.87	lb PM10/vacant lot-yr

Emission Reduction:

Emission Reduction =	56.52	lb PM10/vacant lot-yr

Cost-Effectiveness:

Cost-Effectiveness =	$ 3.98	/lb PM10
=	$ 7,961	/ton PM10

Vacant Lots Stabilized by County if Owners Do Not Respond, Including Use of Property Liens

Number: 41
Class: Vacant Lots

Analysis Unit: vacant lot-yr

Total Cost:	**$1,371**
PM10 Reductions (lb):	**87.4**
PM10 Reductions (tons):	**0.04**
C/E Ratio ($/lb):	**$15.68**
C/E Ratio ($/ton):	**$31,367**

Inspection/Enforcement Cost:

Lien Processing Time, Legal =		3	hr/lien (estimated)
Legal Rate =		$36.06	/hr (Maricopa County, 8/13/96)
Lien Processing Cost, Legal =		$108.17	/vacant lot
Clerical Processing Time =		5	hr/lien (estimated)
Clerical Rate =	$	13.89	/hr (Bureau of Labor Statistics, May 2005 MSA Wage Estimates for Phoenix, mean
Clerical Cost =	$	69.45	/vacant lot
Total Lien Cost =		$177.62	
Average Lien Life =		10	yr (estimated
Capital Recovery Factor =		0.163	
Annualized Lien Cost =		$28.91	/vacant lot-yr

Construction/Operational Cost:

Rock Barrier Rate =		$7.90	/lin ft (Proposed Revised PM10 SIP for the Salt River Area, Arizona DEQ, June 2005)
Average Vacant Lot Area =		3	acres (estimated from land use map in Salt River PM10 SIP, Arizona DEQ, June 2005)
Average Vacant Lot Boundary =		1446	ft
Rock Barrier Cost =	$	11,423	/vacant lot
Useful Life =		20	yr (estimated)
Capital Recovery Factor =		0.117	
Annualized Barrier Cost =		$1,341.78	/vacant lot-yr

Total Cost:

Total Cost =	$1,370.68	/vacant lot-yr

Baseline Emissions:

Trespass Emissions

Average Vacant Lot Trespass Rate =	2	trips/week (estimated)
Average Trespass Trip Distance =	361	ft (estimated)

Emission Factor = $(k)[(s/12)^a][(S/30)^d]/[(M/0.5)^c] - C$

where:

k =	Particle size factor, fraction
s =	Silt content, fraction
S =	Speed, mph
M =	Surface moisture content, %

C =	PM10 emissions from tire wear, brake wear and exhaust		
k =	1.8		
s =	11.9%	(C. Arthur/MAG, 6/16/06 email)	
S =	25	mph (C. Arthur/MAG, 6/16/06 email)	
M =	0.5%	(C. Arthur/MAG, 6/16/06 email)	
C =	0.00047	lb PM10/VMT	
a =	1		
c =	0.2		
d =	0.5		
Baseline Emission Factor =	1.63	lb PM10/VMT	
Annual Emission Rate =	11.6	lb PM10/vacant lot-yr	
Windblown Emissions			
Average Lot Size =	3.0	acres (estimated from land use map in Salt River PM10 SIP, Arizona DEQ, June 2005)	
Average Trespass Distance =	361	ft (estimated)	
Average Trespass Width =	20	ft (estimated)	
Average Trespass Area =	7230	ft2	
=	0.1660	acre	
Windblown Dust Emission Factor =	6.22E-08	g/cm2-sec (Salt River TSD, 9/05)	
=	0.0005	lb/ft2-hr	
Number of Annual High Wind Hours =	23	hr/yr (PM10 Emission Inventory, Engineering-Science, 10/87, Table 3.8)	
Annual Windblown Emissions =	75.8	lb PM10/vacant lot-yr	
Total Annual Emissions =	87.4	lb PM10/vacant lot-yr	

Controlled Emissions:

Controlled Emissions =	0.0	lb PM10/vacant lot-yr

Emission Reduction:

Emission Reduction =	87.4	lb PM10/vacant lot-yr

Cost-Effectiveness:

Cost-Effectiveness =	$ 15.68	/lb PM10
=	$ 31,367	/ton PM10

Schedule Improvements on Parallel Streets to Retain Alternate Route Options Along Major N/S & E/W Corridors

Number: 42
Class: Traffic Flow Improvements

Analysis Unit: vacant lot-yr

Total Cost:	$0
PM10 Reductions (lb):	0.0
PM10 Reductions (tons):	0.00
C/E Ratio ($/lb):	#DIV/0!
C/E Ratio ($/ton):	#DIV/0!

Build Park and Ride Lots Earlier

Number: 43
Class: Transit

Analysis Unit: vacant lot-yr

Total Cost:	$0
PM10 Reductions (lb):	0.0
PM10 Reductions (tons):	0.00
C/E Ratio ($/lb):	#DIV/0!
C/E Ratio ($/ton):	#DIV/0!

Coordinate Public Transit Services with Pinal County

Number: 44
Class: Transit

Analysis Unit: vacant lot-yr

Total Cost:	$0
PM10 Reductions (lb):	0.0
PM10 Reductions (tons):	0.00
C/E Ratio ($/lb):	#DIV/0!
C/E Ratio ($/ton):	#DIV/0!

Increase Fines for Open Burning (Currently $25)

Number: 45
Class: Woodburning

Analysis Unit: unpermitted burn

Total Cost:	$0
PM10 Reductions (lb):	0.0
PM10 Reductions (tons):	0.00
C/E Ratio ($/lb):	#DIV/0!
C/E Ratio ($/ton):	#DIV/0!

Restrict Use of Outdoor Fireplaces & Pits and Ambience Fireplaces in Hospitality Industry

Number: 46
Class: Woodburning

Analysis Unit: outdoor fireplace

	Typical	HighEmis
Total Cost:	$0	$0
PM10 Reductions (lb):	0.0	0.0
C/E Ratio ($/lb):	#DIV/0!	#DIV/0!

Note: For measures with multiple cost effectiveness estimates, the mid point was chosen for display.

APPENDIX B

EXHIBIT 3:

AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMENDATIONS ON THE SUGGESTED LIST OF MEASURES TO REDUCE PM-10 PARTICULATE MATTER. MARCH 28, 2007.

Revised to reflect
MAG Regional
Council approval on
March 28, 2007

TABLE 5 - AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMENDATIONS ON THE SUGGESTED LIST OF MEASURES TO REDUCE PM-10 PARTICULATE MATTER

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
Agriculture The Governor's Agricultural Best Management Practices Committee is in the process of evaluating potential measures to further reduce PM-10 emissions from agriculture for consideration for the Five Percent Plan for PM-10. This Committee was established by law in 1998 (Arizona Revised Statutes, Title 49-457) to develop an agricultural PM-10 general permit that would address the need for controls on agricultural operations. The potential agricultural measures will be presented to the MAG Air Quality Technical Advisory Committee for consideration.						
Fugitive Dust Control Rules						
1. **Public education and outreach (e.g., Clark County) with assistance from local governments** - This measure would involve publicity campaigns (e.g., Bring Back Blue) that increase public awareness of the PM-10 problem and discourage citizens from participating in activities that generate airborne dust.	Recommended on March 1	$7,898/ton (VMT reduction of 0.5% in the nonattainment area)	131 tons/yr (2.9% of target)	Negligible impact on the sources of PM-10 emissions near the monitors on the worst days in 2005/2006	Minor impact, if the public routinely complains about visible dust from sources located near a PM-10 monitor	County, local govts

Source: Maricopa Association of Governments. March 28, 2007.

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
2. **Extensive Dust Control Training Program (e.g., Clark County)** - This measure would involve conducting more frequent dust control training classes and implementing a formal certification program. The County would provide advanced training to representatives of trade associations to qualify them to conduct classes and issue certifications. *The County video on dust control rules and practices will be updated and distributed to public agencies and private companies for use in training their employees.* ***Subcontractors will be included in the dust control training and certification program.***	Recommended on March 1; addition from Measure #2 is shown in italics; addition on March 9 is shown in bold italics.	$12,494/ton (additional water truck full-time on site)	313 tons/yr (6.8% of target) for every 1% increase in Rule 310 compliance	Large impact, when an increased compliance rate is applied to construction sources that contributed to the exceedance at the Higley monitor on 1/24/06	Moderate impact, if training reduces dust generation by construction sources near PM-10 monitors	County, private sector
3. **Core Dust Control Training Program with video provided to local governments and private sector** - This measure involves developing visual and written materials that would be used by the public agencies and private companies to train their employees on the dust control rules and effective dust reduction practices.	Combined with Measure #2 on March 1	$9,990/ton (additional water truck ½ time on site)	313 tons/yr (6.8% of target) for every 1% increase in Rule 310 compliance	Large impact, when an increased compliance rate is applied to construction sources that contributed to the exceedance at the Higley monitor on 1/24/06	Moderate impact, if training reduces dust generation by construction sources near PM-10 monitors	County, local govts, private sector

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
4. **Dust Managers required at construction sites of 50 acres and greater (e.g., Clark County)** - This measure would require a dust manager to be present on construction sites where 50 or more acres of soil are disturbed.	Recommended on March 1	$14,285/ton (additional water truck full time on site)	313 tons/yr (6.8% of target) for every 1% increase in Rule 310 compliance	Large impact, when an increased compliance rate is applied to construction sources that contributed to the exceedance at the Higley monitor on 1/24/06	Large impact, if the manager minimizes dust generation on construction sites near a PM-10 monitor and ensures that all disturbed soil is stabilized during high winds (>15 mph)	County
5. **Dedicated enforcement coordinator for unpaved roads, unpaved parking, and vacant lots (e.g., Clark County)** - This measure would require that additional resources be dedicated to strengthen enforcement of Rule 310.01 for unpaved roads, unpaved parking lots, and vacant disturbed lots.	Recommended on March 1	$534/ton (application of dust palliatives on all 224.3 miles of high traffic unpaved roads)	45 tons/yr (1.0% of target) for every 1% increase in Rule 310.01 compliance for unpaved roads and parking lots	Moderate impact, when an increased compliance rate is applied to the unpaved roads and parking areas that contributed to exceedances at the Salt River Area monitors on 12/12/05 and 2/15/06; small impact due to higher compliance rate for vacant lots that contributed to an exceedance at the Higley monitor on 1/24/06	Large impact, if the increased enforcement of Rule 310.01reduces dust generation from unpaved roads and parking lots near a PM-10 monitor and ensures that disturbed soil on vacant lots is stabilized during high winds (>15 mph)	County

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
6. **Strengthen the stringency and enforcement of the trackout provisions** - This measure would strengthen the existing trackout provisions (e.g.., reduce the 50' length that requires rapid cleanup), include new provisions for dragout (e.g., no visible dust past the property line), and increase the frequency of inspections and notices of violation issued for visible trackout and dragout.	Not Recommended on March 1 due to $2.5M/ton cost-effectiveness	$2,499,750/ton (increased sweeping of unpaved access points by industry)	40 tons/yr (0.9% of target) for every 1% increase in Rule compliance for trackout or dragout	Large impact, when an increased compliance rate is applied to the trackout and dragout that contributed to exceedances at the Salt River Area monitors on 12/12/05 and 2/15/06	Large impact, if the increased compliance reduces trackout on roads near a PM-10 monitor	County
7. **Increase fines for dust control violations and continue to publish the list of violators** - This measure would change ARS 49-463 and 49-513 to increase the current ceiling of $10,000 per day per violation of the County's PM-10 rules and publicize the names of violators and the dollar penalty assessed.	Not Recommended on March 1 due to negligible impacts	Unknown (elasticity of response to increased fines is not available)	Negligible impact	Negligible impact	Negligible impact	State, County
8. **Establish a certification program for Dust Free Developments to serve as an industry standard** - This measure would create a program to certify and publicize companies that routinely demonstrate exceptional efforts to reduce airborne dust.	Recommended on March 1	$10,752/ton (80% emission reduction for participating companies)	313 tons/yr (6.8% of target) for every 1% increase in Rule 310 compliance	Large impact, when an increased compliance rate is applied to construction sources that contributed to the exceedance at the Higley monitor on 1/24/06	Minor impact, if certification results in dust reductions by sources near PM-10 monitors	State, County

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
9. **Better defined tarping requirements in Rule 310 to include enclosure of the bed** - This measure would modify Rule 310 to require that the cargo compartments of trucks whether loaded or empty be fully enclosed prior to traveling on paved public roads.	Recommended on March 1	$14,963/ton (reduction per covered truck, assuming 13 trips/day)	313 tons/yr (6.8% of target) for every 1% increase in Rule 310 compliance	Large impact, when an increased compliance rate is applied to construction sources that contributed to the exceedance at the Higley monitor on 1/24/06	Minor impact, if better tarping reduces dust near PM-10 monitors	County
10. **Conduct just-in-time grading (i.e., once a parcel of land is cleared, stabilization or work on the parcel would be required within a certain number of days)** - This measure would require that disturbed areas (e.g., 10 acres or more) on construction sites would have to be stabilized within a short time (e.g., one week) after grading occurred.	Not Recommended on March 1 due to negligible impacts	Unknown (minimize emissions under high wind conditions)	Negligible impact; already covered by Rule 310	Negligible impact	Negligible impact	County

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
11. **Establish self-monitoring requirements for permitted sources larger than 50 acres** - This measure would require large permitted sources to conduct continuous monitoring to measure meteorological and PM-10 concentrations to determine when dust generation on-site needs to be reduced.	Not Recommended on March 1 due to impact on a small number of permitted sources (i.e., > 50 acres)	$21,530/ton (additional water truck full-time on site)	18 tons/yr (0.4% of target) for every 1% increase in Rule 316 effectiveness; 313 tons/yr (6.8% of target) for every 1% increase in Rule 310 compliance	Large impact, if permitted sources near the Salt River Area monitors take action to reduce dust generation and increase remediation activities (e.g., street sweeping) when PM-10 concentrations at their onsite monitor(s) exceed some threshold value	Large impact, if monitored PM-10 values trigger reductions in emissions near a PM-10 monitor	County
12. **Conduct mobile monitoring to measure PM-10 and issue NOVs** - This measure involves deployment of a vehicle that has been instrumented to monitor PM-10 and meteorological conditions, so that sources can be identified, and immediate remediation and/or enforcement actions taken.	Recommended on March 1	$54,233/ton (use of a gravel bed to control emissions from vehicles traveling on an unpaved surface)	94 tons/yr (2.0% of target) per 1% increase in compliance with dust control rules by nonpermitted sources	Large impact, when the increased compliance rate is applied to the nonpermitted sources that contributed to exceedances at the Salt River Area monitors on 12/12/05 and 2/15/06	Large impact, if the vehicle is used to identify sources and immediately reduce visible dust near PM-10 monitors	County

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
13. **Cease dust generation activities during stagnant conditions** - This measure would require that dust generation activities be curtailed on days between November 1and February 15 when ADEQ issues a High Pollution Advisory (HPA) due to stagnant weather conditions.	Not Recommended on March 1 due to unknown cost effectiveness and negligible impact on five percent reduction requirement	Unknown (During the last 3 years, there have been an average of 8 HPA days, 9 stagnation days, and 10 PM-10 exceedance days between Nov 1 and Feb 15 of each year)	Negligible impact on annual PM-10 emission reductions due to the limited number of days involved	This measure would contribute to modeling attainment at the Salt River Area monitors on 12/12/05 and 12/13/05, but only if curtailment of activities occurred during High Pollution Watches, as well as HPAs. Adding high wind HPA days to the measure would also assist in modeling attainment at the Salt River Area monitors on 2/15/06. If High Pollution Watches on windy days were added, this measure would also be useful in modeling attainment at the Higley monitor on 1/24/06	Moderate impact, if sources near monitors cease dust generation activities on HPA days under stagnant conditions. Impact is diluted by the fact that HPAs do not always coincide with PM-10 exceedance days; also this measure does not address cessation of activities on high wind HPA days	County

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
14. **Establish maintenance requirements for paved roads and parking lots** - This measure would modify Rule 310.01 to require that public and private paved roads and parking lots be maintained to minimize visible dust (e.g., the silt loading level on the paved surfaces should not exceed a specified threshold).	Not Recommended on March 1 due to $320K/ton cost effectiveness	$320,444/ton (Sweep a parking lot once every two weeks)	40 tons/yr (0.9% of target) for every 1% increase in Rule compliance for trackout and dragout	Large impact, when an increased compliance rate is applied to the trackout and dragout that contributed to exceedances at the Salt River Area monitors on 12/12/05 and 2/15/06	Large impact, if the increased maintenance of paved roads and parking lots reduces trackout and dragout near a PM-10 monitor	County
15. **Conduct nighttime *and weekend* inspections** - This measure would involve proactive inspections of nonpermitted and permitted PM-10 sources during non-daylight hours *and on weekends*.	Recommended on March 1; Recommended with additions shown in italics on March 6	$10,752/ton (2 additional water trucks and drivers per facility)	94 tons/yr (2.0% of target) per 1% increase in compliance with dust control rules by nonpermitted sources;18 tons/yr (0.4% of target) for every 1% increase in Rule 316 effectiveness; 313 tons/yr (6.8% of target) for every 1% increase in Rule 310 compliance	Large impact, when the increased compliance rates are applied to the sources that contributed to exceedances at the Salt River Area monitors on 12/12/05 and 2/15/06	Large impact, if the pre-dawn inspections identify sources and initiate actions to immediately reduce visible dust near PM-10 monitors	County

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
16. **Increase inspection frequency for permitted facilities** - This measure would increase the number of proactive inspections conducted at permitted facilities.	Recommended on March 1	$65,765/ton (increase watering to achieve 80% rule compliance)	18 tons/yr (0.4% of target) for every 1% increase in Rule 316 effectiveness	Moderate impact, when the increased compliance rate is applied to Rule 316 sources near the Salt River Area monitors on 12/12/05 and 2/15/06	Moderate impact, if increased inspections result in reductions in PM-10 emissions near a monitor	County
17. **Increase number of proactive inspections in areas of highest PM-10 emissions densities** **- intensify training and education** **- incentive program for compliance** - This measure would focus on the areas of highest PM-10 emissions density: by increasing the number of inspectors and proactive inspections, conducting on-site training, offering incentives to reduce PM-10, and performing community outreach.	Recommended on March 1	$65,900/ton (facilities are inspected twice per day; compliance response: increase haul road watering from once every two hours to once per hour)	18 tons/yr (0.4% of target) for every 1% increase in Rule 316 effectiveness	Moderate impact, when the increased compliance rate is applied to Rule 316 sources near the Salt River Area monitors on 12/12/05 and 2/15/06	Moderate impact, if increased inspections result in reductions in PM-10 emissions near a monitor	County

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
18. **Notify violators more rapidly to promote immediate compliance** - This measure would require inspectors that observe visible dust (e.g., opacity or trackout levels that are approaching rule limits) to call the permit holder and make reasonable efforts to inform a person on-site, so that measures can be taken to prevent, reduce, or mitigate dust generation before a violation occurs.	Recommended on March 1	$6,100/ton (for unpaved parking); $239,050/ton (for vacant lots)	313 tons/yr (6.8% of target) for every 1% increase in Rule 310 compliance; 18 tons/yr (0.4% of target) for every 1% increase in Rule 316 effectiveness	Large impact, when increased compliance rates are applied to sources that contributed to the exceedances at the Salt River Area monitors on 12/12/05 and 2/15/06 and the exceedance at the Higley monitor on 1/24/06	Moderate impact, if the inspector's early notification efforts result in immediate dust reductions by sources near PM-10 monitors	County
Industry						
19 **Fully implement Rule 316** - This measure would enforce the provisions of Rule 316, adopted by Maricopa County in June 2005, for nonmetallic mineral processing sources of PM-10.	Recommended on March 6	$4,802/ton (minimum for a large facility); $59,750/ton (maximum for a small facility)	18 tons/yr (0.4% of target) for every 1% increase in Rule 316 effectiveness	Moderate impact, when the increased compliance rate is applied to Rule 316 sources near the Salt River Area monitors on 12/12/05 and 2/15/06	Moderate impact, if new provisions of rule 316 result in reductions in PM-10 emissions near a monitor	County, private sector
20. **Require private companies to use PM-10 certified street sweepers on paved areas including parking lots (e.g., Clark County)** - This measure will require paved surfaces (e.g., parking lots) owned by private companies to be swept using PM-10 certified street sweepers.	Recommended on March 6	$356,350/ton (Sweep a parking lot once every two weeks)	40 tons/yr (0.9% of target) for every 1% increase in Rule compliance for trackout and dragout	Large impact, when an increased compliance rate is applied to the trackout and dragout that contributed to exceedances at the Salt River Area monitors on 12/12/05 and 2/15/06	Large impact, if the increased maintenance of paved roads and parking lots reduces trackout and dragout near a PM-10 monitor	State, private sector

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21. **Shift hours of operation during stagnant conditions in November through February** - This measure would require that industry delay dust generation activities until 9 a.m. on days between November 1 and February 15 when ADEQ issues a High Pollution Advisory (HPA) under stagnant conditions.	Not Recommended on March 6 due to potential economic disruption	Unknown (During the last 3 years, there have been an average of 8 HPA days, 9 stagnation days, and 10 PM-10 exceedance days between Nov 1 and Feb 15 of each year)	No impact; emissions are deferred, but not reduced	This measure would have a large impact on modeling attainment at the Salt River Area monitors on 12/12/05 and 12/13/05, but only if High Pollution Watch days are added to HPAs; otherwise this measure would have no impact	Moderate impact, if sources near monitors cease dust generation activities on HPA days under stagnant conditions. this impact is diluted by the fact that HPAs are not always issued on PM-10 exceedance days during stagnant conditions	State
21. **Provide incentives to shift hours of operation during stagnant conditions in November through February** - This measure would provide incentives to postpone activities that generate dust until after 9 a.m. on days between November 1 and February 15 when ADEQ issues a High Pollution Advisory (HPA) under stagnant conditions.	Substitute Measure #21 Recommended on March 6					State
22. **Model cumulative impacts for new or modified existing sources** - This measure would require industry to include the impacts of adjacent facilities, when modeling the PM-10 impacts of new facilities or modifications to existing facilities and obtain offsets if concentration thresholds are exceeded.	Not Recommended on March 6 due to uncertainties about the number and size of sources impacted	$109/ton (paving an unpaved road as an emission offset for a new or modified facility); this number will increase as low cost alternatives are selected.	No impact; emissions increases would be offset	No impact	Moderate impact, if the new or modified facility is adjacent to other large sources of PM-10 emissions and is also near a PM-10 monitor	State

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23. **Conduct night time and weekend inspections** - This measure would involve proactive inspections of industrial and construction sources of PM-10 during non-daylight hours and on weekends.	Combined with Measure #15	$10,752/ton (2 additional trucks and drivers per facility)	18 tons (0.4% of target) for every 1% increase in Rule 316 effectiveness; 313 tons/yr (6.8% of target) for every 1% increase in Rule 310 compliance	Moderate impact, when the increased compliance rate is applied to sources near the Salt River Area monitors on 12/12/05 and 2/15/06	Moderate impact, if proactive inspections reduce PM-10 emissions during pre-dawn hours under stagnant conditions near a monitor; negligible value of weekend inspections because exceedances rarely occur on weekends, except as a result of high winds	County
Nonroad Activities						
24. **Ban or discourage use of leaf blowers on high pollution advisory days** - This measure would restrict or prohibit the use of leaf blowers on days when ADEQ issues a High Pollution Advisory (HPA).	Recommended on March 6	$21,851/ton (deferring leaf blowing until the next scheduled visit)	0.004 tons/yr (0.0% of target) per leaf blower not used on a HPA day	Negligible impact	Negligible impact	State, County
25. **Encourage use of leaf vacuums to replace blowers** - This measure would provide incentives and publicity to encourage replacement of leaf blowers with vacuum units.	Not Recommended on March 6 due to lack of impact	N/A (leaf vacuums are not currently designed to capture PM-10; so the emissions reduction would be zero)	No reduction in annual emissions	No impact	No impact	State, County

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26. **Reduce off-road vehicle use in areas with high off-road vehicle activity (e.g., Goodyear Ordinance) - impoundment or confiscation of vehicles for repeat violations** - This measure would involve development and enforcement of ordinances or implementation of other actions to prevent or discourage off-road vehicle use in the PM-10 nonattainment area.	Recommended on March 6	$230/ton (offroad activity in Goodyear ceased within a week)	45 tons/yr (1.0% of target) for restricting off-road vehicle use of 2.1% of the passive open space in the PM-10 nonattainment area (in Goodyear).	No impact in the Salt River Area monitors as measures to reduce off-road vehicle use have already been implemented; moderate impact if implemented in the area impacting the Higley monitor on 1/24/06	Moderate impact if off-road vehicle use is curtailed near PM-10 monitors	State, County, local govts
27. **Create a fund to provide incentives to retrofit nonroad diesel engines and encourage early replacements with advanced technologies** - This measure would establish funding to offer incentives for owners of older nonroad diesel equipment to retrofit or repower existing engines or replace with newer, less-polluting technology.	Recommended on March 6	$44,000/ton of PM-2.5 (particulate filter); $52,000/ton of PM-2.5 (oxidation catalyst)	18 tons/yr (0.4% of target) per 500 nonroad diesel engines are retrofitted with particulate filters and oxidation catalysts	Negligible impact	Negligible impact	State

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28. **Update the statutes to require ultra-low sulfur diesel fuels for nonroad equipment** - This measures would revise ARS 41-2083J to require use of ultra-low sulfur fuel in nonroad engines before the federally-mandated deadline of June 2010. (Locomotives and marine vessels do not have to use the new fuel until 2012.)	Not Recommended on March 6 due to negligible impacts	$16,000/ton of sulfates (use of ultra-low sulfur fuel in a typical nonroad engine)	37 tons/yr (0.8% of target) if **all** nonroad engines in the PM-10 nonattainment area use ultra-low sulfur diesel fuel	Negligible impact	Negligible impact	State
28. **Encourage early implementation of clean fuels for nonroad equipment**. -This measure would provide incentives for nonroad equipment to be retrofitted with diesel retrofit kits, newer clean diesel technologies and fuels; or "green diesel" biodiesel fuel, or other fuels that are cleaner than petroleum diesel.	Substitute Measure #28 Recommended on March 6; description of measure provided by Beverly Chenausky of ADOT on March 8					State
Paved Roads						
29. **Sweep streets with PM-10 certified street sweepers** - This measure would require all public paved roads in the PM-10 nonattainment area to be swept with purchased or contracted PM-10 certified sweepers.	Recommended on March 6	$4/ton (marginal cost and benefit of buying a PM-10 certified instead of a noncertified sweeper)	45 tons/yr (1.0% of target) per PM-10 certified street sweeper	Negligible impact	Moderate impact, if PM-10 certified units are used to sweep streets with high silt loadings on a frequent basis near PM-10 monitors	County, local govts

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30. **Retrofit onroad diesel engines with particulate filters** - This measure would establish a program with financial incentives to encourage the voluntary retrofit of pre-2007onroad diesel vehicles with particulate filters and oxidation catalysts.	Recommended on March 6	$107,000/ton of PM-2.5 (particulate filters); $133,000/ton of PM-2.5 (oxidation catalysts)	39 tons/yr (0.8% of target) per 1,000 vehicles retrofitted with a diesel particulate filter and oxidation catalyst.	Negligible impact	Negligible impact	State, County
31. **Repave or overlay paved roads with rubberized asphalt** - This measure would involve repaving or overlaying paved roads with materials that reduce PM-10 emissions by reducing vehicle tire wear.	Not Recommended on March 6 due to negligible impacts	$631,000/ton (for freeways); $2,681,000/ton (for arterials); $4,290,000/ton (for collectors); 50% reduction in PM-10 emissions due to reduced tire wear	0.032 tons/yr (0.0% of target) per centerline mile of repaved arterial, carrying 10,000 vehicles per day or more	Negligible impact	Negligible impact	State, County, local govts
Unpaved Parking Lots						
32. **Pave or stabilize existing unpaved parking lots (e.g., upgrade to Phoenix Parking Code) - strengthen enforcement** - This measure would involve strengthening and proactively enforcing dust control rules or ordinances that reduce fugitive dust and PM-10 emissions from existing unpaved parking and vehicle manuevering areas.	Recommended on March 6	$1,754/ton (paving a parking lot of one-tenth of an acre); $11,292/ton (applying dust palliatives to the same size lot)	94 tons/yr (2.0% of target) per 1% increase in compliance with dust control rules/ordinances for unpaved parking lots	Large impact, when the increased compliance rate is applied to the unpaved parking areas that contributed to exceedances at the Salt River Area monitors on 12/12/05 and 2/15/06	Large impact, if the increased compliance reduces emissions from unpaved parking and vehicle manuevering areas near a PM-10 monitor	County, local govts

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Unpaved Roads						
33. **Pave or stabilize existing *public* dirt roads and alleys** - This measure would revise Rule 310.01 to require paving or stabilizing of *public* dirt roads that carry less than 150 vehicles per day (e.g., more than 50 vehicles per day).	Recommended on March 6 with additions shown in italics	$109/ton (applying dust palliatives to 224.3 miles of unpaved roads averaging 120 vehicles/day)	32 tons/yr (0.7% of target) per mile of dirt road that is paved	Moderate impact, if dirt roads in the Salt River Area and the Higley modeling domain are paved by 2009	Large impact, if dirt roads near a monitor are paved	County, local govts
34. **Limit speeds to 15 miles per hour on high traffic dirt roads** - This measure would require 15 mph speed limit signs to be posted on dirt roads in the PM-10 nonattainment area that carry high traffic (e.g., 50-150 vehicles per day).	Recommended on March 6	$3,337/ton (speeds are reduced from 25 to 15 mph on 224.3 miles of unpaved roads averaging 120 vehicles/day)	0.5 tons/yr (0.01% of target) per mile of dirt road with 15 mph speed limits; since this would be difficult to enforce, the assumed control effectiveness is low (i.e., 18%).	Negligible impact	Negligible impact	County, local govts
35. **Prohibit new dirt roads including those associated with lot splits** - This measure would prevent the construction of new dirt roads (e.g., prohibit wildcat subdivisions; require paving of roads before issuing a building permit) in the PM-10 nonattainment area.	Recommended on March 6	$2,646/ton (paving one mile of new dirt road)	Without this measure, projected 2007-2009 PM-10 emissions for unpaved roads will increase each year	Moderate impact if new dirt roads are created in the Salt River Area or in the modeling domain for the Higley monitor before 2009	Moderate impact, if new dirt roads are created near monitors	State, County

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Unpaved Shoulders						
36. **Pave or stabilize unpaved shoulders** - This measure would require paving or stabilizing dirt shoulders on paved public roads that carry a high level of traffic (e.g., more than 2,000 vehicles or 50 heavy duty trucks per average weekday).	Recommended on March 6	$18,452/ton (paving of 8-foot dirt shoulders)	40 tons/yr (0.9% of target) for every 1% increase in Rule compliance for trackout and dragout	Large impact, when an increased compliance rate is applied to dragout and trackout emissions from unpaved shoulders that contributed to exceedances at the Salt River Area monitors on 12/12/05 and 2/15/06 and the Higley monitor on 1/24/06	Large impact, if the increased compliance reduces trackout and dragout emissions attributable to unpaved shoulders near a PM-10 monitor	County, local govts
Unpaved Access Points						
37. **Pave or stabilize unpaved access to paved roads** - This measure would require additional measures to reduce trackout and dragout from vehicles accessing paved public roads via unpaved access points (e.g., require paving of access points onto roads with high traffic, e.g., 5,000 vehicles or 50 heavy duty trucks per average weekday).	Withdrawn on March 9 due to duplication with Measure #56	$168,025/ton (gravel pad plus grizzly used by 40 heavy duty trucks exiting a facility with one unpaved access point each day)	40 tons/yr (0.9% of target) for every 1% increase in Rule compliance for trackout and dragout	Large impact, when an increased compliance rate is applied to the dragout and trackout emissions from unpaved access points that contributed to exceedances at the Salt River Area monitors on 12/12/05 and 2/15/06 and the Higley monitor on 1/24/06	Large impact, if the increased compliance reduces trackout and dragout emissions attributable to unpaved access points near a PM-10 monitor	County, local govts

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Vacant Lots						
38. **Strengthen and increase enforcement of Rule 310.01 for vacant lots** - This measure would increase the frequency of inspections and enforcement actions to reduce dust emitted by vacant lots.	Recommended on March 6	$239,000/ton (100% reduction in trespass rates on vacant lots due to placement of barriers)	3 tons/yr (0.07% of target) for every 1% increase in Rule compliance for vacant lots	Small impact, when an increased compliance rate is applied to vacant lots that contributed to the exceedances at Salt River Area monitors on 2/15/06 and the Higley monitor on 1/24/06	Moderate impact, if the increased inspections and enforcement make the soil on vacant lots near monitors less erodible during high winds	County
39. **Restrict vehicular use and parking on vacant lots (e.g., Phoenix)** - This measure would strengthen existing rules and ordinances that prohibit vehicle trespass on vacant land.	Recommended on March 6; The addition of the State as a Potential Implementing Entity was recommended by Maricopa County and approved by the MAG Regional Council on March 28, 2007	$230,700/ton (100% reduction in trespass rates on vacant lots due to placement of barriers)	3 tons/yr (0.07% of target) for every 1% increase in Rule compliance for vacant lots	Small impact, when an increased compliance rate is applied to vacant lots that contributed to the exceedances at Salt River Area monitors on 2/15/06 and the Higley monitor on 1/24/06	Moderate impact, if the strengthened requirements make the soil on vacant lots near monitors less erodible during high winds	State, County, local govts

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40. **Enhanced enforcement of trespass ordinances and codes** - This measure would increase the enforcement of vehicle trespass ordinances and codes for vacant lots.	Recommended on March 6	$51,600/ton (75% reduction in trespass rate due to posting of signs)	3 tons/yr (0.07% of target) for every 1% increase in Rule compliance for vacant lots	Small impact, when an increased compliance rate is applied to vacant lots that contributed to the exceedances at Salt River Area monitors on 2/15/06 and the Higley monitor on 1/24/06	Moderate impact, if the enhanced enforcement of vehicle trespass on vacant lots near monitors decreases soil erosion during high winds	County, local govts
41. **Vacant lots stabilized by County if owners do not respond, liens put on property if necessary (e.g., Clark County)** - This measure would give the County the authority to place a lien against a property owner in order to recover the costs of stabilizing a vacant disturbed lot. 41. **Ability to assess liens on parcels to cover the costs of stabilizing them** - This measure would give the County the authority to provide that the costs of stabilizing the disturbed areas on any vacant lot be assessed upon the property to which the stabilization was applied.	Not Recommended on March 6 due to $236K/ton cost-effectiveness; County concerns about recovering costs Measure recommended by Maricopa County and approved by the MAG Regional Council on March 28, 2007	$235,700/ton (100% reduction in trespass rate due to placement of barriers)	3 tons/yr (0.07% of target) for every 1% increase in Rule compliance for vacant lots	Small impact, when an increased compliance rate is applied to vacant lots that contributed to the exceedances at Salt River Area monitors on 2/15/06 and the Higley monitor on 1/24/06	Large impact, if the authority to place liens is used to stabilize vacant lots near monitors so that soil erosion is minimized during high winds	State, County

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Traffic Flow Improvements						
42. **Schedule improvements on parallel streets to retain alternate route options along major north/south and east/west corridors** - This measure would involve providing and publicizing alternate routes to divert traffic around road construction projects; with the objective of improving traffic flow and reducing vehicle idling.	Not Recommended on March 6 due to negligible impacts	Unknown (decreases in idling and increases in speeds have no impact on PM-10 emissions, except sulfates)	Negligible impact	Negligible impact	Negligible impact	Local govts
Transit						
43. **Build park and ride lots earlier** - This measure would accelerate the construction of park and ride lots to increase transit ridership and carpooling.	Not Recommended on March 6 due to negligible impacts	Unknown (PM-10 from bus exhaust and fugitive dust emissions can be higher than cars; need to carpool or achieve 75% bus occupancy to reduce PM-10 emissions)	Negligible impact	Negligible impact	Negligible impact	Local govts

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44. **Coordinate public transit services with Pinal County** - This measure would involve coordination between Pinal County and public transit agencies in Maricopa County to provide transit service and reduce the number of vehicle trips between the two counties.	Not Recommended on March 6 due to negligible impacts	Unknown (PM-10 from bus exhaust and fugitive dust emissions can be higher than cars; need to achieve 75% bus occupancy to reduce PM-10 emissions)	Negligible impact	Negligible impact	Negligible impact	Local govts
Woodburning						
45. **Increase fines for open burning (currently $25)** - This measure would increase the maximum fine for open burning in ARS Title 49-501 from $25 per occurrence to a level that would serve as a deterrent (e.g., $500 per occurrence).	Recommended on March 6	Unknown (No data on # or size of nonpermitted burns; complaints are twice the number for controlled burns; the latter represent 0.01% of the 2005 PM-10 emissions inventory)	Negligible impact	Large impact on modeling attainment at the West 43rd Avenue monitor on 12/12/05 and 12/13/05	Large impact, if open burning near PM-10 monitors can be curtailed by the imposition of higher penalties	State, County

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46. **Restrict use of outdoor fireplaces and pits and ambience fireplaces in the hospitality industry** - This measure would prohibit burning in outdoor fireplaces, outdoor pits, and ambience fireplaces in the hospitality industry, and ban other nonessential wood fires on days during the period November 1 - February 15 when ADEQ issues a High Pollution Advisory (HPA).	Recommended on March 6	$132,000/ton (restrict use on HPA days), $190,000/ton (retrofit fireplace with EPA-approved device)	Negligible impact	Large impact on modeling attainment at the West 43rd Avenue monitor on 12/12/05 and 12/13/05, but only if outdoor burning is banned during High Pollution Watches, as well as HPAs.	Moderate impact, if restrictions on outdoor burning on HPA days are enforced near PM-10 monitors; this impact is diluted by the fact that HPAs do not always coincide with PM-10 exceedance days	State, County
THE FOLLOWING NEW MEASURES WERE ADDED AFTER FEBRUARY 23, 2007						
Fugitive Dust Control Rules						
47. **Provide timely notification regarding high pollution days** - This measure would provide timely notification to permitted and nonpermitted sources when a High Pollution Advisory or High Pollution Watch is issued by ADEQ.	Recommended on March 9	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	County
48. Target intensive community outreach and educational campaigns on measures to reduce fugitive dust in the areas of highest PM-10 emissions density.	Not Recommended on March 9 due to duplication of Measure #17	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	County

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
49. Develop a PM-10 program for subcontractors (requested by the Maricopa County Board of Supervisors on April 7, 2004) - have subcontractors acquire a dust control permit - give notice of violation to subcontractors	Replaced by new Measure #49 on March 9 (below)	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	County
49. **Develop a program for subcontractors** - This measure would develop a program to register, educate, and give notices of violation (NOVs) to subcontractors through Rule 310. This program would not preclude the issuance of NOVs to the permit holder.	Recommended on March 9	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	County
50. Allow the permit holder to accompany the control officer during an inspection and allow the permit holder 30 minutes to arrive on site. *The inspection can commence without waiting for the permit holder to arrive.*	Not Recommended on March 9 due to potential weakening of existing rules; language in italics was added on March 9	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	County

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
51. Allow the permit holder an opportunity to correct within 24 hours. *This does not preclude the County's issuance of an NOV.*	Not Recommended on March 9 due to potential weakening of existing rules; language in italics was added on March 9	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	County
52. No duplicate fines by MCAQD at the permitted site - Measures #49-51 above are contingent upon this measure.	Replaced by new Measure #52 on March 9 (below)	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	County
52. No duplicate notices of violation (NOVs) or fines by MCAQD at the permitted site.	Not Recommended on March 9 due to potential weakening of existing rules	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	County

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
53. Require property owners within cities, towns and counties in Area A to stabilize vacant lots - Tighten up the language in Rule 310.01.	Not Recommended on March 9 due to duplication of Measure #38	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, counties, local govts
54. Opportunities for notification and rapid compliance for violations of Rule 310.	Not Recommended on March 9 due to duplication of Measure #18	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	County
55. Replace 20 percent opacity limit in Rule 310.01 with "no visible dust across the property line" and proactively enforce for nonpermitted sources - reduces PM-10 emissions from dragout, unpaved roads, unpaved access points, unpaved parking areas and poorly maintained paved roads.	Replaced by new Measure #55 on March 9 (below)	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	County
55. Add "no visible dust across the property line" to Rule 310.01 and proactively enforce for nonpermitted sources - reduces PM-10 emissions from dragout, unpaved roads, unpaved access points, unpaved parking areas and poorly maintained paved roads	Not Recommended on March 9 due to excessive stringency	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	County

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
56. **Reduce dragout and trackout emissions from nonpermitted sources** - This measure would add dragout provisions to Rules 310 and 310.01and enforce dragout and trackout provisions for nonpermitted sources. *For example, trackout from salvage yards would be enforced by the County.*	Recommended with addition shown in italics on March 9	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	County
57. Provide law enforcement certification for inspectors assigned to enforce fugitive dust controls for nonpermitted sources	Not Recommended on March 9 due to limited resources for training inspectors	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	County
58. Covered loads/haul trucks to authorize in Apache Junction portion of Area A (ARS 9-500.27).	Replaced by new Measure #58 on March 9 (below)	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, Pinal County
58. **Cover loads/haul trucks in Apache Junction** - This measure would require loaded and empty haul trucks to be covered in the City of Apache Junction.	Recommended on March 9	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	City of Apache Junction

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
59. Dust control manager required at construction and soil and rock excavation sites of five or more acres in Area A (current threshold for earthmoving permits), ARS 49-459.	Replaced by new Measure #59 on March 9 (below)	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, counties
59. **Require dust coordinators at earthmoving sites of 5-50 acres** - This measure would require an onsite dust control coordinator to be present on sites of 5 to 50 acres during active soil and rock excavation, soil and rock removal, and construction operations, including road construction operations, and related transport activities at access points to paved or unpaved roads. This person could also perform other tasks, but this person would be responsible for managing dust prevention and control on the site.	Recommended on March 9	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	County
General						
60. Expand Area A (ARS 49-541(A))	Withdrawn on March 9 due to limited impact on PM-10	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
Nonroad Activities						
61. **Ban leaf blower from blowing debris into streets** -This measure would ban leaf blowers from blowing debris into the streets *in Maricopa County.*	Recommended on March 6 with change shown in italics	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, County
62. Require cities, towns and the counties in Area A to require leaf blowers rented from facilities to provide an educational piece on reducing particulate matter.	Replaced by new Measure #62 on March 9 (below)	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, counties, local govts
62. **Implement a leaf blower outreach program** - This measure would involve the development and distribution of educational materials on reducing leaf blower dust and would require that the private sector provide the printed materials to customers who purchase or rent leaf blowers.	Recommended on March 9	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	County, private sector

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
63. Require cities, towns and the counties in Area A to ban all-terrain and off-highway vehicles by the public on state lands located within the jurisdiction of the city, town or county (AGC)	Not Recommended on March 6 due to lack of municipal and county jurisdiction over state lands	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, counties, local govts
63. **Regulate and increase enforcement of ATV use on State land** - This measure would require the State to regulate and increase enforcement of all-terrain and off-highway vehicle use on State lands located in Area A.	Substitute Measure #63 Recommended on March 6	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State
76. **Ban ATV use on high pollution days** - This measure would ban ATV use on High Pollution Advisory days in Area A.	Recommended on March 6 as a new measure	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State
Paved Roads						
64. Require cities, towns and the counties in Area A to sweep paved roads.	Not Recommended on March 9 due to duplication of Measure #29	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, counties, local govts

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
Unpaved Surfaces						
65. Require cities, towns and the counties in Area A to stabilize unpaved roads and shoulders.	Not Recommended on March 9 due to duplication of Measures #33 and #36	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, counties, local govts
66. Require cities, towns and the counties in Area A to adopt an ordinance that requires property owners to stabilize unpaved parking lots.	Not Recommended on March 9 due to duplication of Measure #32	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, counties, local govts

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
67. Create particulate mitigation fund with air quality fines used to pave and stabilize land surfaces in and around high pollution areas in Area A.	Replaced by new Measure #67 on March 9 (below)	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, counties, local govts
67. **Create a fund for paving and stabilizing in high pollution areas** - This measure would create a particulate mitigation fund to pave and stabilize land surfaces in and around high pollution areas - establish a grant program for private businesses to stabilize and pave - direct fine monies from Maricopa County for stabilization efforts	Recommended on March 9 with changes shown	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, County, private sector
68. Establish a grant program for private businesses to stabilize and pave around monitors (Home Builders)	Combined with Measure #67 on March 9	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, County
69. Direct fine monies from Maricopa County for stabilization efforts (Home Builders)	Combined with Measure #67 on March 9	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, County

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
70. In areas of high PM-10 emissions density, require paving of: - unpaved roads (including haul roads) - unpaved access points - unpaved parking and vehicle maneuvering areas	Withdrawn due to duplication of other recommended measures	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, County, local govts
Vacant Lots						
71. Give cities, towns and counties in Area A the authority to stabilize vacant lots when an owner fails to do so.	Not Recommended due to same concerns as Measure #41	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, counties, local govts
72. Give cities, towns and the counties in Area A the authority to recoup expenses from a property owner and allow cities, towns and counties in Area A lien authority on property where the city, town or county has stabilized.	Not Recommended due to same concerns as Measure #41	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, counties, local govts

MEASURE	AIR QUALITY TECHNICAL ADVISORY COMMITTEE RECOMMEND-ATION	COST-EFFECTIVENESS OF PM-10 EMISSIONS REDUCED (BASIS FOR CALCULATION)	FIVE PERCENT EMISSIONS REDUCTION TARGET = 4,594 TONS OF PM-10 PER YEAR (% OF TARGET)	MODELING ATTAINMENT AT THE SALT RIVER AREA AND HIGLEY MONITORS ON THE HIGHEST PM-10 DAYS IN 2005/2006	ATTAINING PM-10 STANDARD AT ALL MONITORS IN THE NONATTAINMENT AREA IN 2007, 2008 AND 2009	POTENTIAL IMPLEMENT-ING ENTITY
Woodburning						
73. No burn restriction on PM-10 high pollution advisory days (right now, it's CO only), ARS 11-871.	Withdrawn on March 9, since no burn restrictions already apply on PM-10 HPA days	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, County
74. No burn restriction applied to outdoor hospitality fires and chimineas on PM-10 high pollution advisory days, ARS 49-501 (F).	Not Recommended on March 9 due to duplication of Measure #46	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, County
General.						
75. **Create a dedicated funding source for the Maricopa County Air Program** - This measure would create a dedicated funding source for the County Air Program to support increased enforcement of Rule 310.01, and other air programs, as necessary. Example: Restore In-Lieu funding or some other fee to emissions testing or other approach.	Recommended as a new measure on March 9	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	Measure was received too late to be evaluated	State, County

APPENDIX B

EXHIBIT 4:

STATE ASSURANCES THAT THE STATE HAS THE AUTHORITY TO IMPLEMENT THE MEASURES IN THE PLAN: A.R.S. SECTION 49-406 I. AND J.

STATE ASSURANCES THAT THE STATE HAS THE AUTHORITY TO IMPLEMENT THE MEASURES IN THE PLAN: A.R.S. SECTION 49-406 I. AND J.

chapter. After the director has provided prior written notice to the control officer describing the reason for asserting jurisdiction and provided an opportunity to confer, the county or multi-county air quality control region shall relinquish jurisdiction, control and enforcement over such permits as the director designates and at such times as he asserts jurisdiction at the state level. The order of the director which asserts state jurisdiction shall specify the matters, geographical area, or sources over which the department shall exercise jurisdiction and control. Such state authority shall then be the sole and exclusive jurisdiction and control to the extent asserted and the provisions of this chapter shall govern, except as provided in this chapter, until jurisdiction is surrendered by the department to such county or region.

C. Portable sources under jurisdiction of the department under subsection A, paragraph 6 of this section may be required to file notice with the director and the control officer who has jurisdiction over the geographic area that includes the new location before beginning operations at that new location.

D. Notwithstanding any other law, a permit issued to a state regulated source shall include the emission standard or standard of performance adopted pursuant to section 49-479, if such standards are more stringent than those adopted by the director and if such standards are specifically identified as applicable to the permitted source or a component of the permitted source. Such standards shall be applied to sources identified in subsection A, paragraph 2, 3, 4 or 5 of this section only if the standard is formally proposed for adoption as part of the state implementation plan.

E. The regional planning agency for each county which contains a vehicle emissions control area shall develop plan revisions containing transportation related air quality control measures designed to attain and maintain primary and secondary ambient air quality standards as prescribed by and within the time frames specified in the clean air act. In developing the plan revisions, the regional planning agency shall consider all of the following:

1. Mandatory employee parking fees.
2. Park and ride programs.
3. Removal of on-street parking.
4. Ride share programs.
5. Mass transit alternatives.
6. Expansion of public transportation systems.
7. Optimizing freeway ramp metering.
8. Coordinating traffic signal systems.
9. Reduction of traffic congestion at major intersections.
10. Site specific transportation control measures.
11. Reversible lanes.
12. Fixed lanes for buses and car pools.
13. Encouragement of pedestrian travel.
14. Encouragement of bicycle travel.
15. Development of bicycle travel facilities.
16. Employer incentives regarding ride share programs.
17. Modification of work schedules.
18. Strategies for controlling the generation of air pollution by nonresidents of nonattainment areas.
19. Use of alternative fuels.
20. Use of emission control devices on public diesel powered vehicles.
21. Paving of roads.
22. Restricting off-road vehicle travel.
23. Construction site air pollution control.
24. Other air quality control measures.

F. Each regional planning agency shall consult with the department of transportation to coordinate the plans developed pursuant to subsection E of this section with transportation plans developed by the department of transportation pursuant to any other law. 1994

49-404. State implementation plan

A. The director shall maintain a state implementation plan that provides for implementation, maintenance and enforcement of national ambient air quality standards and protection of visibility as required by the clean air act.

B. The director may adopt rules that describe procedures for adoption of revisions to the state implementation plan.

C. The state implementation plan and all revisions adopted before the effective date of this section remain in effect according to their terms, except to the extent otherwise provided by the clean air act, inconsistent with any provision of the clean air act, or revised by the administrator. No control requirement in effect, or required to be adopted by an order, settlement agreement, or plan in effect before the enactment of the clean air act in any area which is a nonattainment area for any air pollutant may be modified after enactment in any manner unless the modification insures equivalent or greater emission reductions of the air pollutant. The director shall evaluate and adopt revisions to the plan in conformity with federal regulations and guidelines promulgated by the administrator for those purposes until the rules required by subsection B are effective. 1992

49-405. Attainment area designations

A. The governor may designate the status and classification of areas of this state with respect to attainment of national ambient air quality standards.

B. The director shall adopt rules that both:

1. Describe the geographic extent of attainment, nonattainment or unclassifiable areas of this state for all pollutants for which a national ambient air quality standard exists.

2. Establish procedures and criteria for changing the designations of areas that include all of the following:

(a) Technical bases for proposed changes, including ambient air quality data, types and distributions of sources of air pollution, population density and projected population growth, transportation system characteristics, traffic congestion, projected industrial and commercial development, meteorology, pollution transport and political boundaries.

(b) Provisions for review of and public comment on proposed changes to area designations.

(c) All area designations adopted by the administrator as of May 30, 1992. 1992

49-406. Nonattainment area plan

A. For any ozone, carbon monoxide or particulate nonattainment area the governor shall certify the metropolitan planning organization designated to conduct the continuing, cooperative and comprehensive transportation planning process for that area under 23 United States Code section 134 as the agency responsible for the development of a nonattainment area plan for that area.

B. For any ozone, carbon monoxide or particulate nonattainment area for which no metropolitan planning organization exists, the department shall be certified as the agency responsible for development of a nonattainment area plan for that area.

C. For any ozone, carbon monoxide or particulate nonattainment area, the department, the planning agency certified pursuant to subsection A of this section on behalf of elected officials of affected local government, the county air pollution control department or district, and the department of transportation shall, by November 15, 1992, and from time to time as necessary, jointly review and update planning procedures or develop new procedures.

D. In preparing the procedures described in subsection C of this section, the department, the planning agency certified pursuant to subsection A of this section on behalf of elected officials of affected local government, the county air pollution control department or district, and the department of transportation shall determine which elements of each revised implementation plan will be developed, adopted, and implemented, through means including enforcement, by the state and which by local governments or regional agencies, or any combination of local governments, regional agencies or the state.

E. The department, the planning agency certified pursuant to subsection A of this section on behalf of elected officials of affected local government, the county air pollution control department or district, and the department of transportation shall enter into a memorandum of agreement for the purpose of coordinating the implementation of the procedures described in subsection C and D of this section.

F. At a minimum, the memorandum of agreement shall contain:

1. The relevant responsibilities and authorities of each of the coordinating agencies.
2. As appropriate, procedures, schedules and responsibilities for development of nonattainment area plans or plan revisions and for determining reasonable further progress.
3. Assurances for adequate plan implementation.
4. Procedures and responsibilities for tracking plan implementation.
5. Responsibilities for preparing demographic projections including land use, housing, and employment.
6. Coordination with transportation programs.
7. Procedures and responsibilities for adoption of control measures and emissions limitations.
8. Responsibilities for collecting air quality, transportation and emissions data.
9. Responsibility for conducting air quality modeling.
10. Responsibility for administering and enforcing stationary source controls.
11. Provisions for the timely and periodic sharing of all data and information among the signatories relating to:
   (a) Demographics.
   (b) Transportation.
   (c) Emissions inventories.
   (d) Assumptions used in developing the model.
   (e) Results of modeling done in support of the plan.
   (f) Monitoring data.

G. Each agency that commits to implement any emission limitation or other control measure, means or technique contained in the implementation plan shall describe that commitment in a resolution adopted by the appropriate governing body of the agency. The resolution shall specify the following:

1. Its authority for implementing the limitation or measure as provided in statute, ordinance or rule.
2. A program for the enforcement of the limitation or measure.
3. The level of personnel and funding allocated to the implementation of the measure.

H. The state, in accordance with the rules adopted pursuant to section 49-404, and the governing body of the metropolitan planning organization shall adopt each nonattainment area plan developed by a certified metropolitan planning organization. The adopted nonattainment area plan shall be transmitted to the department for inclusion in the state implementation plan provided for under section 49-404.

I. After adoption of a nonattainment area plan, if on the basis of the reasonable further progress determination described in subsection F of this section or other information, the control officer determines that any person has failed to implement an emission limitation or other control measure, means or technique as described in the resolution adopted pursuant to subsection G of this section, the control officer shall issue a written finding to the person, and shall provide an opportunity to confer. If the control officer subsequently determines that the failure has not been corrected, the county attorney, at the request of the control officer, shall file an action in superior court for a preliminary injunction, a permanent injunction, or any other relief provided by law.

J. After adoption of a nonattainment area plan, if, on the basis of the reasonable further progress determination described in subsection F of this section or other information, the director determines that any person has failed to implement an emission limitation or other control measure, means or technique as described in the resolution adopted pursuant to subsection G of this section, and that the control officer has failed to act pursuant to subsection I of this section, the director shall issue a written finding to the person and shall provide an opportunity to confer. If the director subsequently determines that the failure has not been corrected, the attorney general, at the request of the director, shall file an action in superior court for a preliminary injunction, a permanent injunction, or any other relief provided by law.

K. Notwithstanding subsections A and B of this section, in any metropolitan area with a metropolitan statistical area population of less than two hundred fifty thousand persons, the governor shall designate an agency that meets the criteria of section 174 of the clean air act and that is recommended by the city that causes the metropolitan area to exist and the affected county. That agency shall prepare and adopt the nonattainment area plan. If the governor does not designate an agency, the department shall be certified as the agency responsible for the development of a nonattainment area plan for that area. 1994

49-407. Private right of action; citizen suits

A. Except as provided in subsection B, a person having an interest which is or may be adversely affected may commence a civil action in superior court on his own behalf against the director alleging a failure of the director to perform an act or duty under this article or article 2 of this chapter that is not discretionary with the director. The court has jurisdiction to order the director to perform the act or duty.

B. No action may be commenced in any of the following cases:

1. Before sixty days after the plaintiff has given notice of the alleged violation to the director and to an alleged violator.
2. If the director determines no violation has occurred, or if the director has initiated an administrative enforcement action by issuing a warning letter, notice of violation or issuing an order.
3. If the attorney general or county attorney has commenced and is diligently prosecuting a civil action